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THESIS

A COGNITIVE AND PEDAGOGICAL EVALUATION FRAMEWORK FOR COMPUTER-BASED TRAINING

by

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September 2003

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This thesis research examines the effectiveness of a newly developed cognitive and pedagogical evaluation framework to assess computer-based instruction. All training programs must have comprehensive evaluation guidelines in place to ensure the quality of instruction from the classroom-training environment to the virtual training environment is not diminished. The application of sound cognitive and pedagogical principles helps ensure that an organization's training goals will be met. This research developed a set of practical guidelines, or a template, that should be used to evaluate the cognitive and pedagogical aspects of any given computer delivered course of instruction. This template is used to evaluate the United States Navy's newly developed CD-ROM Surface Warfare Officer (SWO) training course. The SWO course is the basic professional training for junior Ensigns that is now contained on CD-ROM and delivered by personal computer.

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A COGNITIVE AND PEDAGOGICAL EVALUATION FRAMEWORK FOR COMPUTER-BASED TRAINING

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This thesis research examines the effectiveness of a newly developed cognitive and pedagogical evaluation framework to assess computer-based instruction. All training programs must have comprehensive evaluation guidelines in place to ensure the quality of instruction from the classroom-training environment to the virtual training environment is not diminished. The application of sound cognitive and pedagogical principles helps ensure that an organization's training goals will be met. This research developed a set of practical guidelines, or a template, that should be used to evaluate the cognitive and pedagogical aspects of any given computer delivered course of instruction. This template is used to evaluate the United States Navy's newly developed CD-ROM Surface Warfare Officer (SWO) training course. The SWO course is the basic professional training for junior Ensigns that is now contained on CD-ROM and delivered by personal computer.

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EXECUTIVE SUMMARY

This thesis research examines the effectiveness of a newly developed cognitive and pedagogical evaluation framework to assess computer-based instruction. All training programs must have comprehensive evaluation guidelines in place to ensure the quality of instruction from the classroom-training environment to the virtual training environment is not diminished.

Chapter II provides background information on human sensory perception, short and long term memory, problem solving, and learning. Chapter III is a review of sound instructional and pedagogical principles for developing Computer-based Training (CBT) and evaluative framework development for assessing CBT initiatives. Chapter IV is the analysis of the strengths and weaknesses of the United States Navy's newly developed CD-ROM Surface Warfare Officer (SWO) training course. The SWO course is a basic professional course of instruction for junior Ensigns that is mostly contained on CD-ROM and delivered through the use of a personal computer. Chapter V is the recommendations that arise out of the analysis conducted in Chapter IV.

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I. INTRODUCTION

As the use of computers to enhance and replace traditional classroom instruction increases, evaluation guidelines must be developed and implemented to ensure that the quality of instruction is not diminished. Much has been written about why and how to successfully implement organizational computer-based training systems. However, little has been mentioned about how to evaluate whether specific cognitive and pedagogical principles are being effectively employed. The application of cognitive and pedagogical principles helps to ensure that the organization's training goals will be met.

This research developed a set of practical guidelines, or a template, that should be used to evaluate the cognitive and pedagogical aspects of any computer delivered course of instruction. In this thesis, the template is used to evaluate the United States Navy's newly developed CD-ROM Surface Warfare Officer (SWO) course. The SWO basic course is the first professional course of instruction for junior Ensigns that is mostly contained on CD-ROM and delivered through by personal computer.

A. BACKGROUND

In 2002 the United States Navy's Surface Warfare Officer (SWO) community dramatically changed the way its newly commissioned junior officers receive their introductory specialty training. The SWO community has shifted the delivery method from traditional classroom and laboratory training to a Compact Disk Read Only Memory (CD-ROM) distance-learning environment that is supplemented by on-the-job training (OJT). The Navy awarded the contract to re-engineer the then current curriculum to Intelligent Decision Systems, Inc (IDSI) in mid-2002. The delivery date was December 2002. In January 2003, all newly commissioned Ensigns in Surface Warfare started reporting directly to a ship, vice the Naval Education and Training Center, Newport, Rhode Island, and were issued the new courseware, and the commencement of warfare specialty training.

B. PROBLEM STATEMENT

Human perception, memory, and critical thinking skills are all cognitive processes that must be considered by anyone that is involved in developing courses of learning, whether those courses are taught by a human instructor or learned in a virtual training environment. According to Filbert and Weatherspoon (1993), designers of interactive learning systems must take into account the appropriate cognitive learning theories and instructional design paradigms prior to constructing their systems, so the learning systems that are developed will have instructional effectiveness (p.1).

Just as it is important to properly design instructional systems, it is important to design and implement effective evaluation guidelines. Without effective evaluation, an organization will not know if its training objectives are being adequately met. Furthermore, organizational leadership may not know if the training methods that are being employed are the best techniques available to maximize student learning throughout the organization's training domain.

Due to the short duration between the letting of the contract and the date that deliverables were due, IDSI had to hire subcontractors, and utilize off-the-shelf products where available and applicable. However, it is possible that by doing so, the program emphasis was on building a working course of instruction rather than building a course of instruction that would best fit the students needs.

Consequently, if the courseware (instructional material and delivery method) does not adequately meet the students' needs, then it does not meet the Navy's needs. If the Navy's needs are not being met by the CD-ROM training program, then other alternatives, including the possibility of returning to previous methods of instruction need to be identified and acted upon.

C. SCOPE OF THESIS

The scope includes: (1) A relevant review of human memory, cognitive models, and learning theories, (2) a review of current methods that are used in the arena of Information Technology and Distance Learning to implement an

effective computer-based training environment, (3) development of an evaluative framework that is sufficient to evaluate the cognitive and pedagogical aspects of Computer-Based Training, (4) completion of a cursory analysis of the United States Navy's Division Officer classroom-based course of instruction for Surface Warfare Officers and an in-depth analysis of the reengineered CD-ROM based curriculum and methods of delivery. The thesis will conclude with predictions for the eventual success or failure of the redesigned curriculum where the use of Information Technology has been implemented and will offer suggestions, if any, for the improvement of the pedagogy and curriculum. At this time there are no objective data available for comparing computer-based to conventional instruction. Accordingly, the course assessment is based primarily on instructional quality assessment measures, instructional design and computer-based delivery pedagogical guidelines.

D. LIMITATIONS

In its Division Officer at Sea Training Program Overview, IDSI identifies seven key elements that comprise the SWO DIVO At Sea training program. Those elements are an Individual Development Plan (IDP), Interactive Courseware (ICW), Practicums, Practical Problems, Case Studies, Shipboard Experiences, and Assessment (p. 3-1). IDSI's overview emphasizes four instructional categories, namely ICW, Practicums, Practical Problems, and Case Studies, which are important to the successful implementation of this training endeavor. However, this thesis will primarily focus on the curriculum integration strategy, and in particular, a critical analysis of the instructional strategies and delivery methods employed to create the SWO division officer interactive courseware.

E. METHODOLOGY

In order to evaluate whether a course of instruction meets its objectives, one must be aware of the cognitive and pedagogical principles that must be satisfied in order to ensure that learning occurs. Consequently, this thesis first examines leading cognitive and pedagogical models and theories of learning. A generic evaluative model for evaluating computer-based instructional delivery

systems is developed and presented. Although developed primarily to analyze computer-based instructional systems, with minor modifications, it is useful in evaluating traditional educational environments as well. Next, the traditional (classroom) Surface Warfare Officer Curriculum is briefly examined and then the evaluation template is used to thoroughly evaluate the relative strength and weaknesses of the reengineered SWO courseware against existing cognitive and pedagogical principles. Finally, the evaluation results are summarized and all conclusions and recommendations presented.

Qualified Surface Warfare Officers serving as training officers aboard their respective ships completed surveys developed for supervisors. These officers have all successfully passed the Surface Warfare course of instruction at Newport, Rhode Island, and having mastered the skills that Ensigns will be required to learn, have earned the right to wear the Surface Warfare Pin. Ensigns that are currently enrolled in the new SWO basic course completed surveys that were developed for students. The Ensigns were used because it is important to discover how individuals who are actually taking the computer-based course feel about the way it is being delivered. It cannot be overemphasized that if the students' needs are not being met, then they are probably not learning to the best of their potential, and consequently, there is a high probability that the organization's training objectives are not being met.

F. ORGANIZATION OF PAPER

Chapter II examines memory, cognition, and a review of the major theories of learning. Chapter III details the basics of a typical distance-learning program and develops a model for the successful evaluation of a computer-based course of instruction. Chapter IV reviews various aspects regarding the traditional SWO classroom-based course of instruction and evaluates the cognitive and pedagogical aspects of the reengineered SWO CD-ROM based courseware. Chapter V presents conclusions and recommendations for improvements to this new course of instruction.

II. MEMORY, COGNITION, AND LEARNING

Human perception, memory, and cognition play an important role in CBT programs. To effectively develop learning materials for students, course designers must take the way people learn into account. To varying degrees, mankind processes information similarly. There are, of course, disputes among theorists about how this process works, but that does not change the fact that human beings sense, process, synthesize, remember, and recall information in the same way. Since psychology has such a large impact on education and training, it is appropriate to include information about memory, cognition, and human learning in any research that is related to CBT.

A. MEMORY

For the purposes of this paper, human memory is the ability to store, process, retain, and recall information over the course of a lifetime. Memory is tremendously important. Dix, Finlay, Abowd, and Beale (1997) demonstrate that most of our everyday activities rely on memory, either in the storage of actual facts, or the knowledge of actions or procedures. Our memory allows us to repeat actions, use language, and utilize new information that is received via our senses (p. 26). Humankind is endowed with the ability to perceive our environment. This perception comes as a result of taste, smell, sight, hearing, and touch, which are the five senses.

1. Senses

Wickens (1992) states each one of the five human sensory systems is equipped with a central mechanism that prolongs the representation of a physical stimulus for a short period of time after the stimulus has stopped (p. 17). This is known as the Short Term Sensory Store (STSS). Additionally, Wickens (1992) and Dix et al (1997) contend that when a person's attention is diverted, the STSS acts as a "stimuli" buffer, and permits environmental information to be temporarily preserved so that it can be dealt with later. According to Dix et al. (1997), a STSS exists for each sensory channel: iconic memory for visual stimuli, echoic memory for aural stimuli, and haptic memory for touch p. 17).

Wickens (1992) relates three general characteristics of the STSS:

(1) The STSS is preattentive. This means no conscious attention is required to prolong the image during the natural "time constant" of the sensory store (p. 18).

(2) The STSS is relatively veridical, preserving most of the physical details of the stimulus (p. 18).

(3) The information in the STSS decays rapidly. The iconic store holds sensory data for less than one second. The echoic and haptic stores generally hold information between two and eight seconds (p. 18).

2. Short-Term Memory

Information that is resident within a STSS must be acted upon if it is to be remembered. Anderson (2000) shows information that was left "unattended" in a STSS was quickly lost. Attended, or acted upon information, went into short-term memory (p. 172). Short-term memory has become synonymous with working memory. Anderson (2000) and Breuer (1990) also demonstrated if short–term memory was not acted upon, or rehearsed, it was quickly forgotten as well. Dix et al. (1997) believe working memory acts as a "scratchpad" for the temporary recall of information (p. 28).

Short-term memory has a limited capacity. Anderson (2000) reports the number of elements in a sequence that a person can ordinarily repeat back without error is between seven or eight (p. 17). For example, a person can usually remember a seven-digit phone number quite easily. However, if that phone number includes an area code, bringing the number of digits to ten, it often becomes necessary to write the number on a piece of paper and rehearse it before it is recalled correctly. Anderson (2000) believes the number of rehearsals control the amount of information that is transferred to long-term memory (p. 17). In fact, Anderson (2000) argues that study time and the amount of practice with a given data set directly contributes to a person's ability to accurately recall that data when it is needed. Figure 1 shows the relationship between senses, short-term memory, and long-term memory.

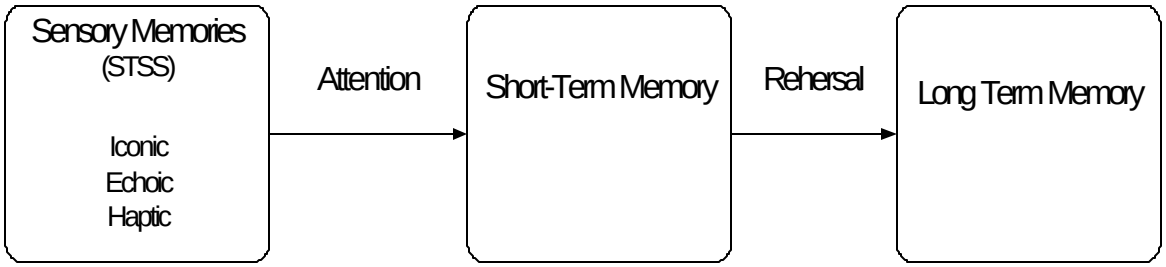

Figure 1. Sensory to Long-term memory (From Dix et al., 1997, p. 27)

CBT design should take into account the need to act on information multiple times so it can be sent from STSS through short-term memory to long-term memory.

3. Long-Term Memory

Anderson (2000), Wickens (1992), and Dix et al. (1997) show sensory information is acted upon and processed by progressively higher neural centers, and as it continues to be acted upon, it will eventually be perceived or recognized, and then stored in long-term memory. Dix et al. (1997) contend long-term memory is a human beings main resource for storing factual information, experimental knowledge, and procedural rules of behavior (p. 30). Dix et al. (1997) discuss two types of long-term memory. There is episodic memory, which is a memory of events and experiences in a serial form. There is also semantic memory, which is structured to allow access to information, representation of relationships between pieces of information, and inference (p. 31). Long-term memory differs from short-term memory in two very distinct ways. First, Long-term memory has a nearly infinite capacity. Second, forgetting happens at a much slower rate.

4. Semantic Memory Maps

Anderson (2000) states that in one's semantic memory, information is broken down categorically. Thus, structure is represented as a hierarchy of categorized facts. Categorized facts are then associated with the different categories (p. 152). A semantic network is a series of interconnected semantic maps. Figure 2 shows a representation of a semantic memory map.

Schemas are developed from semantic networks. Anderson (2000) contends that since schemas are built from semantic networks, the sum of our knowledge about a semantic category can be captured (p. 154). Anderson (2000) also argues that categories have attributes, and that many of those attributes have a "default" value associated with them. Furthermore, if somebody recognizes an object as belonging to a certain category, that person can infer that the object has the default values associated with that concept's schema (p. 154). Figure 2 is an example of a semantic map.

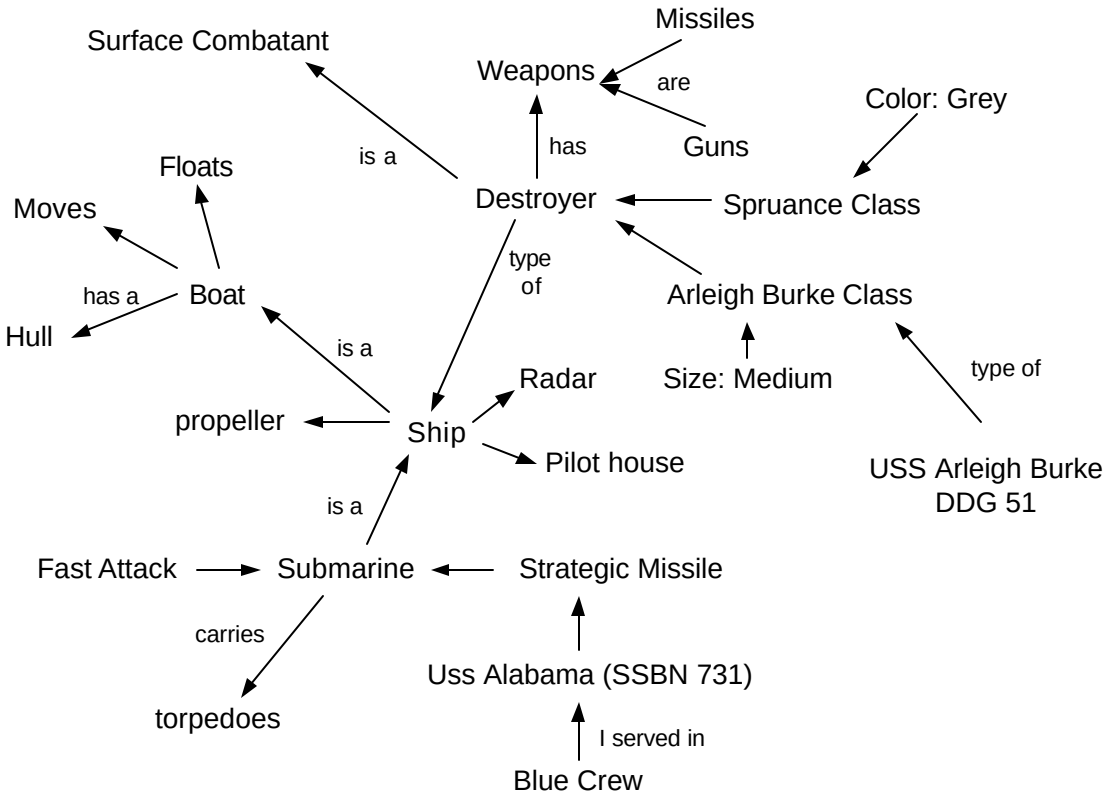

Figure 2. A semantic mapping of ships (After Anderson's (2000) model (p. 152))

5. Memory Relevance

It is very important that curriculum developers understand the different aspects of human memory processes so CBT presentations can be constructed that take full advantage of the way people learn, and maximize the educational benefit to students. If a series of CBT lessons are related, and the ways in which they are related are incorporated into the presentations, the students are in fact

given the means to make mental connections between the various information groups and categories. Consequently, it is possible to use CBT to improve the way students construct semantic maps, ultimately improving memory and performance.

B. KNOWLEDGE APPLICATION AND REASON

Anderson (2000) describes three ways humans acquire knowledge. These are by personal discovery, through instruction (being told), and by observing somebody else's performance (p. 246).

1. Knowledge

There are two types of knowledge. Anderson (2000) states these are declarative knowledge and procedural knowledge. Declarative knowledge is also known as explicit knowledge, and is the knowledge we are consciously aware of, including facts, dates, events, etc. Procedural knowledge is the knowledge of how to perform cognitive activities. This type of knowledge is often implicit (p. 238).

Knowledge acquisition, or learning, can be classified into two categories: tactical learning and strategic learning. As students practice problems they learn the sequences of actions required to solve problems or portions of problems. Anderson (2000) classifies this as tactical learning (p. 290). Students also learn how to organize problem-solving techniques, particularly as problems get large and complex. Anderson (2000) labels this as strategic learning (p. 292). The more information students learn about a subject, the more it is assumed they understand about that subject. Wiggins (1998) defines understanding as a sufficient grasp of concepts, principles, or skills so that one may bring them to bear on new problems and situations, deciding in which ways one's present competencies can suffice and in which ways one may require news skills or knowledge (p. 84). Student understanding, then, must be a major goal of any educational endeavor.

2. Reasoning

Reasoning is the application of knowledge to solve problems or perform tasks. Dix et al. (1997) contend that reasoning occurs in three distinct ways:

deductively, inductively, and through abduction. Deductive reasoning means conclusions are logically derived from a set of given or known premises. However, a logical conclusion cannot be equated to "truth". Just because something should logically be a certain way, does not mean it is really that way. When using inductive reasoning, a person generalizes from a set of known facts to infer information about cases that have not yet been seen. Using abductive logic, a person would step logically from a given fact to the action or state that caused it (pp. 38-40).

3. Expertise

Over time, and through the use of learning strategies, reasoning, and problem solving, a person may become known as an expert about a given subject. Anderson (2000) describes three stages of skill acquisition and expertise. These stages are the cognitive stage, the associative stage, and the autonomous stage. In the cognitive stage, sets of relevant facts are committed to memory. In the associative stage, two actions occur. First, errors in the initial understanding are gradually detected and eliminated. Second, the connections among the various elements required for successful performance are strengthened (p. 281). The outcome from this stage is the internalization of a successful procedure for the performance of a given skill set. In the autonomous stage, Anderson (2000) states that procedural knowledge produced in the associative stage becomes more and more automated and rapid. Since skills are becoming more automatic, they require fewer processing resources (p. 282). For a given skill set, a person operating in this stage will generally be accepted as a subject matter expert (SME).

C. TRANSFER

Allessi and Trollip (1991) and Ellis (1965) define transfer as skills or performance in one situation influencing behavior in other situations. Transfer is also commonly used to describe taking information learned in an educational environment and applying it to situations that occur outside of the classroom. Ellis (1965) reports that the influence of transfer is found in intellectual tasks, complex motor skills, and in emotional responses and attitudes (p. 3). Three

types of transfer can occur as a result of instruction. They are positive transfer, negative transfer, and zero transfer.

Positive transfer can be defined as the performance of one task aiding in the performance of a second task (Ellis, 1995, p. 4). Ellis (1995) argues the act of driving a car can be used to explain transfer. Assume a teenager has learned to drive the family car. Assuming a similar transmission, that teenager should have little difficulty driving the neighbor's car (p. 4).

Ellis (1965) defines negative transfer as the performance on one task inhibiting or disrupting the performance on a second task (p. 4). Ellis (1995) again uses the act of driving a car as an example. Learning to drive in the United States is different than learning to drive in Great Britain. A person that has lived and driven in the United States for a prolonged period of time would more than likely find it very difficult to drive in Great Britain, on the left side of the road (p. 5). This is an example of negative transfer.

Zero transfer means that the performance of one task has no effect on the performance of another.

There are many factors that affect the degree of transfer that occurs between one task and another. Ellis (1965) contends that task similarity, response similarity, and the time between tasks all influence how much transfer occurs.

In general, increased task similarity results in increased positive transfer unless the stimulus is the similar but the responses are different. Ellis (1965) explains this phenomenon by demonstrating a motorist's behavior while at a traffic signal. Consider changing the rules to "go" on orange instead of going on green. Since the color orange is similar to red, which means stop, motorists would have problems adapting to the new rules. However, if the green lights were replaced with blue ones, and then the rule was changed to go on blue, it would take little time before all the motorists had adapted to the change.

When a person must make new responses to similar stimuli, negative transfer usually results. Ellis (1965) uses a person learning another language as an example. Consider the person fluent in English who is attempting to learn German. Now consider the word, “wand”. In English, a wand is the Fairy Godmother’s tool. In German, it means a wall. Ellis’ research shows that the person will have a difficult time remembering and using the German definition properly.

It was reported by Ellis (1965) that transfer remains constant, even with intervals that vary between zero and ninety days between tasks (p. 39). Transfer of learning appears to be stable and independent of any memory of the original tasks.

Bastiaens and Martens (2000) contend that teaching students outside the context of the actual work environment results in a low transfer of knowledge and skill (p. 8). Not surprisingly, Bastiaens and Martens (2000) advocate the use of on-the-job training (OJT) for organizational training. It is possible that OJT has a few advantages over the traditional classroom approach. Bastiaens and Martens (2000) argue that in an OJT environment, the learning environment and the job location are the same, and positive transfer will increase (p. 8). It is also argued that since the learning process in an OJT environment is more active and concrete than in the classroom, transfer will improve (Bastiaens and Martens, 2000, p. 8).

While OJT does possess educational benefits, it is also likely that learning and transfer from this form of training are at times reduced. Transfer also occurs in the affective domain. The affective domain is primarily constructed of attitudes and opinions. A person that thinks poorly of his or her place of employment may possess negative feelings toward any OJT. It is also possible that the training day is often interrupted, which will diminish the impact of OJT.

D. LEARNING PRINCIPLES

The subject of learning is both broad and extremely complex. In order to construct a useful CBT program, it is important to have an elementary

understanding of how students learn and what instructors, even if the instructor is a computer, can do to enhance the learning process. Understanding the three learning domains that exist in each person, the concept of metacognition, and the four human factors that affect learning are very important. By understanding how these principles work together, curriculum developers can construct CBT software that will allow students to maximize their learning potential.

1. Krathwohl, Bloom, and Bertram's Domains

Krathwohl, Bloom, and Bertram (1964) define three domains in which learning occurs. These are the cognitive, affective, and psychomotor domains. These domains are defined in terms of intellectual, mental, or physical objectives. Depending upon what a organization's particular training objectives are, activities can be developed that stimulate student learning across each of these domains. If, however, an organization has poorly defined learning objectives, it makes it harder to develop specific training activities that will both meet the objectives and enhance learning and transfer throughout these three domains.

a. Cognitive Domain

This is the intellectual part of a person. This is the domain that is responsible for knowledge acquisition, recall, and problem solving. Krathwohl, Bloom, and Bertram (1964) define the cognitive domain as objectives which emphasize remembering or reproducing something which has presumably been learned, as well as objectives which involve the solving of some intellective task for which the individual has to determine the essential problem and then reorder given material or combine it with ideas, methods, or procedures previously learned (p. 6).

b. Affective Domain

Krathwohl, Bloom, and Bertram (1964) define the affective domain as objectives that emphasize a feeling, tone, emotion, or a degree of acceptance or rejection. This is simply a person's attitudes, values, feelings, emotions, and biases (p. 6).

c. Psychomotor Domain

Krathwohl, Bloom, and Bertram (1964) define the psychomotor domain as objectives that emphasize some muscular or motor skill, some manipulation of material and objects, or some act that requires neuromuscular coordination, such as writing, speech, or a trade (p. 7).

2. Metacognition

Stolovitch (2003) defines metacognition as the set of higher-level control processes that guide our deliberate information processing activities. It is in essence, the mind's "Operating System" (OS) (p. 88). Stolovitch (2003) identifies five such processes. They are planning, selecting, connecting, tuning, and monitoring (p. 90).

These processes are bipolar. On one end are characteristics that a good learner typically exhibits. On the opposite pole are the characteristics that a poor learner generally displays. Positions on this scale are not static, but dynamic. Over time, a person can improve their performance within one or all of these processes' spectrums with practice.

a. Planning

The process of planning ranges from a poor learner not knowing what to do to a good learner reasoning out what must be done by creating and executing an organized plan of action (Stolovitch, 2003, p. 90).

b. Selecting

The process of selecting ranges from a poor learner not knowing where to turn or select what is important to learn to the good learner listening, studying, analyzing, and sifting through information, identifying and selecting the critical elements (Stolovitch, 2003, p. 90). In other words, the good students are able to figure out what is important to learn.

c. Connecting

Stolovitch (2003) contends that those who do not connect well view new content as a mass to be analyzed and will attempt to memorize that content without linkages to known skills and knowledge. Those who do connect well continually seek to build linkages with their prior knowledge (p. 90).

d. Tuning

Stolovitch (2003) argues that those that are poor at tuning will only obtain a fuzzy understanding of new knowledge and will be unable to pull that knowledge into focus. On the other hand, good students intentionally practice with new information until it is brought into a clear and sharp focus (p. 90).

e. Monitoring

Students with poor monitoring skills use known learning strategies whether those strategies work or not. These students tend to apply more effort into one strategy if a learning outcome is negative, or unproductive, than to apply a different strategy. Students who can effectively monitor replace unproductive or insufficient strategies with ones more likely to work (Stolovitch, 2003, p. 90).

Stolovitch (2003) believes that teachers can help students of all ages improve in each of these areas by designing learning activities that guide students in the application of these skills, which forces them to actively think about and evaluate what they are doing and why they are doing it (p. 88).

3. Factors that Affect Learning

There are four factors that have an impact on the way a student learns. These factors are: ability, prior knowledge, motivation, and thinking style.

a. Ability

Stolovich (2003) defines ability as the capacity with which we were born that enables us to acquire new skills and knowledge (p. 36). This is also known as intellectual capacity, and it varies from person to person. Those with a high intellectual capacity will typically understand and recall information better than those without such a capacity.

b. Prior Knowledge

Prior knowledge is defined as how much a person already knows about what is being currently taught. Stolovitch (2003) states that prior knowledge helps the learner acquire additional knowledge or skills more quickly (p. 37).

c. Motivation

Motivation can be defined several ways. I prefer to define motivation as a person's desire to achieve a stated purpose or goal. Stolovitch (2003) believes that motivation is affected by three factors: value, confidence, and mood (p. 37). Stolovitch (2003) argues, and it makes sense, the more a person values something; the more motivated that person will be with respect to what is valued. In terms of learning, this means that the more value a person affixes to learning, the more motivated that person will be to learn.

Additionally, Stolovitch (2003) argues that confidence plays a large part in a person's motivation. If a person feels completely inept at something it is unlikely they will be motivated to do or try it (p. 38).

Stolovitch (2003) believe that a person's personal feelings affect their moods, and that those moods affect motivation (p. 38). A positive environment tends to improve one's mood, and consequently, improve motivation (Stolovitch, 2003, p. 38).

There are two forms of motivation. Allessi and Trollip (1991) describe them as intrinsic motivation and extrinsic motivation. Intrinsic motivators are things that are inherent in the instruction that motivate a student (p. 31). Allessi and Trollip (1991) describe exploratory environments, challenging assignments, tasks that stimulate curiosity, and encouragement as methods that increase a student's intrinsic motivation (p. 31). Allessi and Trollip (1991), describe extrinsic motivators as those that are independent of the instruction (p. 31). Paying a student for good grades is an example of an extrinsic motivator. Allessi and Trollip (1991) argue that when extrinsic motivators are used, the student's interest is diminished because the goal becomes the reward instead of learning (p. 31).

1. Learning Environment and Motivation. The learning environment can have a large impact on a student's motivation. There are four different learning environments. Kirkpatrick (1998) describes them as discouraging, neutral, encouraging, and requiring. In a discouraging

environment, the supervisor often says, “I want it done this way”, irrespective of the actual organizational rules. A person is not often told directly not to do something, but behavior is regulated through insinuation. According to Allessi and Tollip (1991), a neutral environment is one in which the boss ignores the fact that trainees have attended training (p. 21). In effect, the boss is saying, “I do not care what you have learned, do it this way.” In an encouraging environment, the organization assists the student in transferring what was learned in training to the job. The “requiring” environment is the most difficult to implement. In this environment, the supervisor knows what the subordinate learns and then ensures that the students’ learning transfers to the job (Allessi and Trollip, 1991, p. 21).

Based upon these descriptions, organizations should strive to implement either encouraging or requiring environments. By doing so, more transfer will take place between training and the job, trainee satisfaction and motivation will increase, and the organization will benefit from a better-trained, more responsive workforce.

d. Thinking Styles

Sternberg (1997) argues that in addition to ability, prior learning, and motivation, thinking styles significantly impact a person’s ability to learn. Sternberg (1997) identifies three distinct thinking styles. They are legislative, executive, and judicial. Legislative thinkers like to come up with their own ways of doing things. They also prefer to decide for themselves what they will do and how they will do it by creating their own rules. Legislative thinkers tend to make good writers, scientists, artists, and bankers (Sternberg, 1997, pp 20-21).

Sternberg (1997) states that executive thinkers like to follow rules and prefer problems that are prefabricated. They like to fill in gaps that exist within existing structures rather than create the structures themselves. They also like applying rules to problems. These types of thinkers make good lawyers, police officers, contractors, and soldiers (p. 21).

Judicial thinkers like to evaluate rules and procedures, preferring problems in which one analyzes and evaluates existing constructs and ideas (Sternberg, 1997, p. 21). Sternberg (1997) argues that these people like writing critiques, giving opinions, and judging people and their work. Judicial thinkers make good judges, critics, program evaluators, consultants, and systems analysts (p. 21).

Since people all operate using different thinking styles, questions placed on a test will usually result in different answers, depending on the thinking style of the person asked. It is important to keep each of these styles in mind when constructing tests and activities with which to evaluate students. This is because a test constructed one way may favor a particular thinking style over another. Asking for the same information in different ways or constructing multiple activities that demonstrate the same skill are methods for eliminating any bias that may exist with respect to the students' thinking styles.

E. APPROACHES TO LEARNING

There are many theories about how to best teach students. The three that will be discussed in this research are the behaviorist theory, the constructivist theory, and the cognitive theory. Some theories have more relevance in a traditional classroom, while some seem to fit best within the confines of some computer-based environments. Each theory has both advantages and disadvantages with respect to the learning environment in which it is applied. The goal of this research with respect to learning theories is to highlight the basic similarities and differences between the theories and to briefly discuss possible strengths or weaknesses of the three theories in the context of organizational training via CBT.

1. Behaviorism

Smith-Grato (2000) traces the roots of behaviorism to Skinner's Theory of Programmed Instruction (p. 228). Programmed instruction was founded on learning principles largely determined by animal learning studies.

Kidd (1965) believes that learning is primarily the alteration of behavior that results from experience (p. 154). Kidd (1965) is saying that we learn from

what we do, not from what we accomplish (p. 154). When I was a young boy, I touched a hot burner on a stove. Having learned from my experience, I have never again touched a stove burner that may even have been hot.

Kidd (1965) describes the principle known as the “curves of practice”. This principle demonstrates that for a given activity, the gains in learning or expertise increases the more that activity is practiced (p. 156). Consider a person learning to play the guitar. The more a person practices playing the guitar, the better he or she will become.

Desypris (2002) lists three steps that behaviorists believe need to be performed in order to effectively teach. They are:

(1) Instructors must identify the objectives to be learned.

(2) Instructors must create a learning environment that assists the learner in acquiring these goals. This environment includes stimulus that will engage the learner.

(3) Instructors must review, examine, and consider adopting existing materials into their curriculums before developing new ones (p. 18).

Behaviorism was a very popular theory in the 1950’s and 1960’s. Behavioral learning principles tended to emphasize simple, incremented steps representing a particular task domain. The behavioral method of programmed instruction has been successfully applied in limited training environments on tasks that require performance of simple procedures. Even though this form of instruction largely ignores human problem solving abilities and higher cognitive skills, it still provides a nice foundation on which to build.

2. Cognitive Theory

Duffy and Jonassen (1992) describe cognitive science as multidisciplinary, drawing on psychology, linguistics, anthropology, philosophy, and artificial intelligence (p. 20). Duffy and Jonassen (1992) argue that the mind is essentially viewed as an instantiation of a computer, manipulating symbols the same way that a computer does. These “symbols” acquire meaning when an external and

independent realty is “mapped” on them as during our interaction with the world. Cognition is the rule-based manipulation of these symbols (p. 20). Leflore (2000) states that individuals develop maps and schemas to help them understand the world. Individuals will reorganize existing concepts when those concepts interact with new experiences (p. 105).

Because of this, Desypris (2002) argues that the course must include problems that the student will solve in step, taking advantage of acquired knowledge in each step (p. 18). Additionally, Desypris (2002) contends that in order for instruction to be effective, it is the teacher’s responsibility to ensure that each student is ready to learn the core concepts that will be taught.

Leflore (2000) provides four basic guidelines that instructors can utilize when developing course content:

(1) Provide students with elements that help them structure and organize the information they are expected to learn. Providing students with an outline of the material they are going to learn is an excellent method for accomplishing this task (p. 105).

(2) When appropriate, use a concept development activity (p. 105). An example of this would be to ask aspiring students in a nautical navigation class to draw the light configuration of a particular ship, or class of ships.

(3) Decide how students’ prior knowledge will be activated (p. 105).

(4) Use graphics, animations, and sounds that are related to the content being taught (p. 105).

3. Constructivism

The theory of constructivism has gained in popularity as the Internet, and distance learning has gained in popularity. Duffy and Jonassen (1992), Leflore (2000), and Smith-Gratto (2000) contend what makes this theory unique is its tenet that the students construct their own meaning, or schemas, based on their unique individual experiences. Duffy and Jonassen (1992) argue learning is an active process, built on the internal representations of knowledge, which has

been constructed from personal interpretations of one's experience. This knowledge is constantly open to change and its structures and linkages form the foundation to which knowledge structures are appended (p. 21). One way of interpreting this viewpoint is through the semantic mapping model. When a person is young, the structure of their semantic map is limited and small. Over time, as this person experiences life, those mappings become large, complex, and interconnected.

Duffy and Jonassen (1992) and Leflore (2000) contend that for any meaningful learning to occur, it must be situated in a rich context and filled with real-world problems for students to solve. Leflore (2000) states simulations provide enough fidelity for students to explore real-world problems from multiple vantage points and will enable students to "construct" good problem solving skills (p. 112).

According to Desypris (2002), this theory puts students in charge of their own learning. Consequently, course content must be well structured in order to provide continuity of learning to the students. Since experience plays such a large role in this theory, interaction among participants is a very important element in the construction of structured knowledge.

Smith-Gratto (2000) describes three potential problems that can occur when teaching using this method:

(1) Students may not meet the required objectives because facts, skills, and concepts may not have been learned. This can happen if students are required to make meaning from unfamiliar content. If students' experiences do not overlap with new information, it is unlikely that the concept will be successfully learned (p. 233).

(2) It is possible that students will not construct a proper foundation on which to build (p. 233).

(3) Constructivist activities are very time consuming (p. 233).

4. Conclusion

By understanding how the human mind receives, stores, processes, and retrieves information, CBT developers can design courseware solutions that give students the best opportunity to maximize their learning potential. On the other hand, it is likely that CBT courseware that is neglectful of how we learn will fail to meet the organizational objectives for which it was designed.

Although these three theories have been presented independently, there is nothing to prevent curriculum developers to combining ideas and activities from each one in order to provide an optimum learning environment for their students. By doing so, developers can maximize the benefit offered by a particular theory and minimize the associated weaknesses that are also inherent.

III. COMPUTER-BASED LEARNING

For any educational initiative to be successful, whether it is teaching English to fifth-graders or training potential pilots how to master the mechanics of a particular aircraft, two things must occur. First, the curriculum must be sound. This means, among other things, the information being presented must be accurate, comprehensive, relevant, and timely. Second, the information must be effectively communicated, or delivered, to the students. Using appropriate Instructional Design techniques generally allows for the development of a sound curriculum. Proper pedagogical principles must be adhered to in order to produce quality instructional presentations.

The quality of instructional design and delivery techniques is assessed through the use of evaluations. Evaluations allow organizations to determine if training, and the performance goals that arise out of the completion of the training, are being met or exceeded. The evaluation framework that is presented at the end of this chapter was constructed by researching instructional design and pedagogical principles that have been proven to be effective in a CBT environment and then building a template that checks to see if those characteristics are present in the course of instruction being evaluated.

A. INSTRUCTIONAL DESIGN

Instructional Design can be defined as, “The process of designing the environment, methods, and resources for effective learning and objectives by students (Boettcher and Conrad, 1999, p. 42). As quoted by Desypris (2002), Hiltz, Teles, and Turoff contend, “attention to instructional design is one of the most critical factors in successful learning networks... All education involves intervention by an expert to organize the content, sequence instructional activities, structure task and group interaction, and evaluate the process (p. 20).”

Bloom (1956) describes curriculum development, or instructional design, as a four-step process that begins with asking what educational purposes or objectives the course seeks to attain? Once answered, the developer must

create learning experiences which will likely bring about the attainment of the objectives. Next, the course should be sequenced to enhance transfer and avoid isolated learning experiences. Finally, the effectiveness of the learning experiences must be evaluated (p. 18). In their faculty guide, Boetcher and Conrad (1999) develop a comprehensive four-part model for developing instruction that does not conflict with Bloom's early model. The model's components are comprised of Analysis, Learning Objectives, Selection, and Evaluation (Boetcher and Conrad, 1999, p.17).

1. Analysis

The first step in the instructional design process is to conduct an analysis of the students and what they will be learning. A teacher must know who the students are, what they already know or do not know, and what they will need to know to consider the training program a success.

In his book Educative Assessment, Wiggens (1998) defines a standard as something that describes a specific and desirable level or degree of exemplary performance irrespective of whether most people can or cannot meet it (p.106). He also contends that for any education or training program to achieve success, three standards must exist. First, Content Standards need to be in place. This describes what the student should know and be able to do (p. 106). Second, Performance Standards need to be created. This standard describes how well students must do their work. Third, Task Standards must be implemented. This describes what tasks the students must be able to perform (p. 106).

It is important that designers realize that without analyzing what the training program is intended to accomplish, what the students need to know, and how to best teach the students what you want them to learn, the training initiative may very well fail.

2. Learning Objectives

The learning objectives become the standard by which the training program is judged. Poorly defined learning objectives hinder the evaluation process, of both the students and the program. Learning objectives formally

define what it is the students are expected to learn as a result of participating in the training program.

3. Selection

Selection describes the process of choosing teaching strategies, picking the content that will be taught, and selecting the methods that will be used to assess the program. More than one teaching strategy may be appropriate for teaching a particular class. For example, an instructor may decide to use multiple teaching strategies by using Internet delivery methods coupled with several classroom lectures. Content selection is very important. The instructor should verify that the course content would satisfy the learning objectives. Methods used to assess both the course and the students should be selected. This means the developer must decide what is to be evaluated, how it is to be evaluated, and when it will be evaluated. Once this is decided, the developer must decide what to do with the information collected via the evaluations.

4. Evaluation

There are two fundamental evaluation types: Those performed by the instructor, and those performed by the institution. Instructors generally evaluate student performance through observation, quizzes, and examinations. Institutions usually assess the curriculum, the instructor, or the program. Opinion surveys, questionnaires, and direct observation by organizational representatives are common methods of evaluation employed by institutions when evaluating program effectiveness.

B. PEDAGOGICAL DESIGN

All educational curriculums must be properly delivered if their content is to be understood, remembered, and used later by the students. Even the best instructional designs can be rendered impotent if the content is not efficiently and effectively presented to the students. It is not difficult to envision a teacher presenting otherwise interesting material to students in a way that is so boring most students in the class are uniformly wondering when the lesson will be mercifully over (how good the instructional design was becomes irrelevant if and when this ever occurs). A poor teacher can easily render an entire course

ineffectual through poorly designed, or if designed well, poorly executed delivery methods. To be successful, different delivery methods must employ different tactics to gain the students' attention, peak their interest, and motivate them to learn the material. The traditional classroom environment emphasizes different techniques than does the computer-based environment, although the ultimate goal is the same.

1. Classroom Instruction versus Computer-based Delivery

Traditional instruction and computer-based training both have advantages and disadvantages. A course developer must be familiar with the pros and cons of each technique in order to select a delivery method that best suites the organization's needs. The traditional classroom environment features information taught by an instructor or through a textbook. This information is taught linearly, or in a set sequence. Classroom training is synchronous, meaning that communications take place in real-time. Web-based and computer based training can provide information from varied sources, many times via a multimedia presentation that makes use of hyperlinks. A hyperlink is an embedded doorway that when clicked on with the mouse pointer, takes the student to the webpage associated with that link. Hypermedia is the use of multiple hyperlinks, and through the use of those links, allow the students to control where they go within the framework of the lesson in order to obtain their learning material. Multimedia is the use of two or more forms of communication (e.g. pictures, sounds, video, etc) to present information to a target audience via a computer. Communication with the instructor can be asynchronous or synchronous. Asynchronous means that there is a delay between the time a communication is sent and the time it is received. Electronic mail (email) is an example of asynchronous communication. Table 1 highlights the differences between traditional training and web-based training methods.

	Lecture-Textbook Learning Paradigm	Web-based Learning Paradigm
Main Sources of Information	Teacher or Textbook	Various Internet Resources including online textbooks
Format of Information	Mostly Lecture or Text	Mostly Multimedia
Presentation Format	Linear	Mostly Hypermedia
Interaction Type	Synchronous	Asynchronous/Synchronous

Table 1. Differences between Lecture-textbook and web-based learning paradigms

Horton (2000) describes several advantages to instructor-led training:

(a) The instructor can answer questions and solve problems as they arise (p. 55).

(b) Instructors provide authority that some learners may need for motivation (p. 55).

(c) An instructor can adjust the course to suit the needs of a particular class (p. 55).

(d) Instructors can grade the activities and tests too subtle for automated scoring (p. 55).

In my opinion, the ability of instructors to motivate the students to learn is the most important of these characteristics. Since an unmotivated student is likely to learn less than a motivated student, it is very important that instructors are able to effectively perform this function. This does not mean an instructor needs to take on the role of an enforcer, as the connotation of motivator might imply. It does mean that the teacher is able to provide a rich, interesting, and safe learning environment that attracts and inspires students to learn.

Traditional classroom instruction also possesses a few inherent problems. First, not all instructors are created equal. Multiple instructors may teach the same course of instruction, which means students taking the same class may not receive the same quality of instruction. Second, this is generally considered "passive" learning, meaning the teacher stands in front of the class and lectures while the students take notes. This form of learning is not very interactive, which

does not allow the students much time to mentally work with the information and transfer it from STSS to long-term via short-term memory. Consequently, This style of teaching may not produce as much positive transfer among the student population as other more interactive methods.

Computer-based training possesses several advantages over traditional instruction. In Designing Web-Based Training, Horton (2000) lists several:

(a) Learners develop self-reliance that is needed after the class (p. 55).

(b) Learners are not required to conform to the instructor's schedule (p. 55).

(c) All learners get the same quality of learning experience (p. 55).

Developers today can create stunning graphics and visual effects, embed video and audio, and produce highly entertaining and interesting presentations that grab and hold students' attention. Coupled with the advantages listed above by Horton, powerful learning tools can be created that allows the students to, in essence, take control over their own learning.

Despite its potential powerful advantages, CBT does have several possible disadvantages. One of weaknesses of computer-based training is that it is generally more expensive to deliver than traditional teaching methods. In today's fiscally conscious environment, it is not surprising that most courses and CBT web sites are not very interactive, and fall well short of initial expectations (Parikh and Sameer, 2002, p. 28).

Another potential drawback of CBT is that there is substantially less instructor control and struggling students may not get the much-needed help they require to successfully complete the training. If students feel isolated, or are not motivated to learn, they may not take responsibility for their coursework. Subsequently, this may lead to a high rate of attrition. Unmotivated trainees are unlikely to seek help if cumbersome processes are involved.

Parikh and Sameer (2002) state there is no feedback loop between instructors and students unless a technically complex and cumbersome login function is added to the courseware (p. 29). This type of secure instructor-

student feedback loop can add considerable costs to a CBT or web-based training initiative. However, not including this functionality with the CBT courseware may lead to feelings of isolation and the subsequent motivation issues discussed in the previous paragraph.

Finally, there is the potential to rely too heavily on technology when designing CBT. In the end, technology cannot replace the human teacher in education. Yeung (2002) believes that although technology can be used to leverage instructors' time, it cannot replace most human contact without significant quality losses.

2. Stolovich's Five-Step Model for Training

It is essential to formally structure the training students receive. This is true regardless of the delivery method, as it reasonably assures the organization that all students will receive approximately the same training irrespective of who the instructor is. Stolovitch and Keeps (2003) present a comprehensive five-step model for structuring training. Figure 3 shows this model. This model includes the following steps:

(1) Rationale. Explain what it is you want the students to learn. This serves to motivate the students to learn the important information since it has a high value associated with it (p. 68).

(2) Objective. Stolovitch and Keeps (2003) suggest that by telling students what they will be able to do at the end of the lesson, there is a better chance they will learn it (p. 70).

(3) Activities. Learning activities guide students toward the fulfillment of the stated learning objectives (p. 71). These activities should be stimulating, contributing to students' experiences, imaginations, and judgments (p. 71).

(4) Evaluation. Student evaluation verifies what the students have learned. It determines the degree to which the learner has met each objective for the desired level of performance (p. 72). The most common evaluative techniques are tests and performance appraisals (p. 73).

(5) Feedback. Done correctly, feedback lets the learners know what they did correctly and provides constructive help when they have done something wrong (p. 73). There are two forms of feedback: corrective and confirming. Corrective feedback explains how students can obtain, or meet, a stated learning objective (p. 73). Confirming feedback is a reward for attaining a learning objective (p. 73).

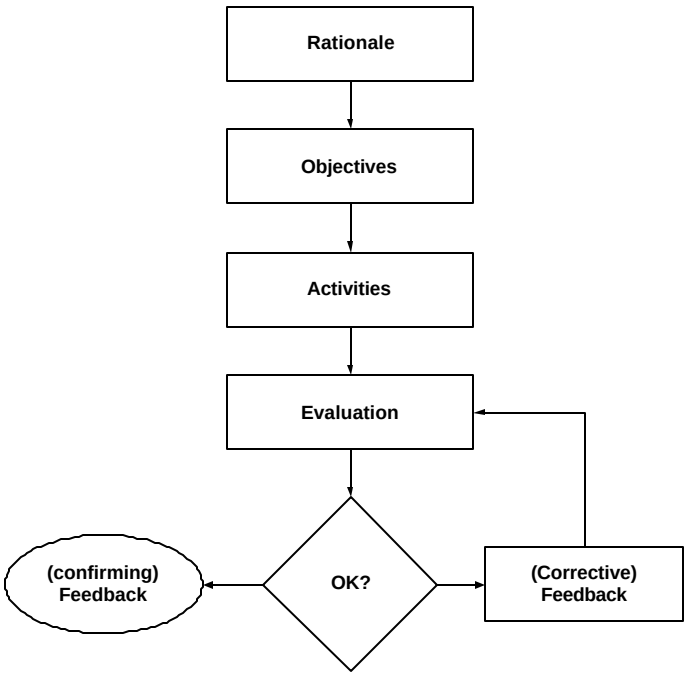

Figure 3. Five-step Model for Training (From Stolovitch and Keeps, 2003, p. 69)

Although Stolovitch and Keeps (2003) present a fairly comprehensive model, it lacks a function that verifies the instructional interface is appropriate for the training being conducted. It is important to examine instructional interface in CBT because the computer becomes the teacher. How a student interacts with the computer during CBT many have an impact on whether the student is able to realize the maximum educational benefits of the training. The evaluation framework presented at the end of this chapter will assess instructional interface in CBT. Lohr and Eikleberry (2001) define instructional interface as, "the elements in any product or system that support the tasks of the learner while he or she is learning (p. 25)." Lohr and Eikleberry (2001) continue by stating this

interface can be human-based, computer-based, paper-based, or a combination thereof (p.25). This interface is the link between the student and the information or tasks being learned, and appears to be directly linked to the teaching method and is an integral part of answering some of the fundamental questions students ask, such as, “Am I being graded?” or “What am I supposed to do now?” (Lohr and Eikleberry, 2001, p. 25). When a CBT system lacks human instructors that would otherwise guide, inspire and answer questions, a well-designed and properly functioning instructional interface is critical. Instructional Interface will be examined in more detail in a later section of this thesis.

3. Computer-based Pedagogical Design Principles

Distance Learning can be an efficient way for organizations to conduct training. Computer-based instruction using active, self-paced learning with individualized feedback can reduce total learning time by 30 to 40 percent (Desypris, 2002, p. 13). In fact, Horton reports that California State University at Northridge, Office Depot, Merrill Lynch, and Toys R Us have all generated significantly better training results since beginning Distance Learning initiatives (p. 26).

a. Potential Drawbacks

Despite these successes enjoyed by many organizations, CBT is not without potential problems. It is possible that meanings will be misinterpreted (Horton, 2000, p.37). If a student does not adequately understand the instruction then it is likely that some of the presentation will be misinterpreted. The fact that there is no human instructor only exacerbates this problem if it occurs. Another potential problem that arises from the use of CBT is that there are very few ways to get a student “unstuck” (Horton, 2000, p. 37). Horton (2000) also raises the fact that there is very little socialization that occurs when one learns alone (p. 37). He argues that this leads to two potential problems. First, a student is unable to learn from his or her classmates (p. 37). Second, if lonely because of insufficient socialization, a student’s motivation will decline (p. 37). Lastly, there are too many possible disruptions (p. 37). As one who has first-hand experience with classes that have had much of the required information presented on-line, I

can attest to the fact it was often difficult to find, download, read, and absorb the material in a timely manner due to all the interruptions and disruptions. In my opinion, this is potentially the biggest problem area of all. Unfortunately, it is also the one sphere of influence that a course developer has the least amount of control over.

b. General Issues

Most of CBT's potential pitfalls can be avoided by taking advantage of the development principles others have found successful. As a general rule, Allessi and Trollip (1991) contend that the course developers must answer several questions during the development process:

(a) Is the use of the computer appropriate (p.486)?

(b) Is the methodology appropriate (p. 486)?

(c) Are the lesson lengths appropriate (p. 486)?

(d) Is the mastery level appropriate for each topic (p. 486)?

c. Student Interaction

Once these questions are satisfactorily answered, developers can critically examine other aspects of their initial design. How the students will interact with the computer is an issue developers must closely scrutinize. Belanger and Jordon (2000) contend that interactivity is the key element of the learning environment, and define it as the degree of intellectual, emotional, and physical engagement of the learner to the instructional content using computer-based Distance Learning technologies (p. 23). Belanger and Jordon (2000) describe four successively more complex levels of student interactivity. They are from least to most complex: Passive, Limited Participation, Complex Participation, and Real-time participation (p. 134). Passively oriented text and graphics are not generally considered the optimal choice for use when developing an integrated CBT program. This method can be used for teaching sets of basic facts or rules (Belanger and Jordon, 2000, p. 134).

Interactive text presents learners with different pages of content, depending on the selections they make during the course of the lessons.

Belanger and Jordon (2000) recommend using an index or hyperlinks for navigation (p. 138). By using hyperlinks throughout a lesson, information from one lesson can be linked to information in other lessons. Belanger and Jordon (2000) believe interactive text and graphics reinforces the ways in which the material relates to other topics. The amount of student transfer increases because facts and processes just learned are immediately practiced (p. 139).

The most expensive, complex, and fully interactive type of distance learning instruction is interactive multimedia (Belanger and Jordon, 2000, 139). Belanger and Jordon (2000) explain that when using interactive multimedia, interactive text is combined with video, sound, animation, and high-resolution graphics to provide a rich learning environment (p. 139). According to Belanger and Jordon (2000), a highly interactive CBT environment decreases students' sense of isolation, allows more senses to be used during the learning process, and students are engaged vice learning through passive listening, which increases interest and motivation (p. 21).

It is important that developers properly select the most appropriate level of interactivity with respect to organizational training objectives. Different lessons, or even different parts of the same lesson, may require different levels of interactivity. These requirements, linked back to the learning objectives, are what drive the interactive complexity of each topic.

Allessi and Trollip (1991) recommend that developers ask five basic questions about how students will interact with the computers when deciding on how interactive to make a lesson:

(a) Is interaction frequent (p.486)?

(b) Is comprehension enhanced (p. 486)?

(c) Is memory enhanced (p. 486)?

(d) Is transfer enhanced (p. 486)?

(e) Are there a variety of student interactions with the computer (p. 486)?

If these questions cannot be answered in the affirmative, then it is probable that students will be victimized by at least one of the problems listed in this chapter, such as boredom, low motivation, misinterpretation of instructional material, inability to proceed any further, etc. Frequent interaction with interesting material keeps students' interests high while simultaneously providing motivation to learn. From experience, a series of long PowerPoint presentations, where the students only interaction is hitting the enter key to advance along one slide at a time is neither interesting nor motivating.

Another approach used to assess this aspect of design is to ask if there is a teacher in the interface (Lohr and Eikleberry, 2001, p. 24). This takes into account the fact a human instructor is absent while the student is actively learning. By frequently asking this question while designing a course, developers can build-in software applications that take on the role of an instructor, or an assistant, while students are using the program.

d. Human-Computer Interface

There are many different types of human-computer interaction styles which developers can implement for use in a training program. It is best if one style is selected and used throughout the entire range of associated training topics instead of changing styles from topic to topic. Changing styles will only confuse and frustrate the students taking the class. In fact, Horton (2000) argues that designers should modularize the course, separating it by loosely associated topics. This will minimize the dependence between topics (p. 174). Whichever method is used, the students will need to use an input device (e.g. mouse, keypad, etc) to interact with the computer. Allessi and Trollip (1991) contend that designers must carefully select the method of inputting selections into the computer and that the selected method's interface should assist in preventing or detecting any student errors. Some of the more popular styles include Menus, WIMP (Windows, Icons, Menus, and Pointers), and Point and Click (Dix et al., 1997, p. 115).

Dix et al. (1997) describe menus as a set of on-screen options that are selected using an input device. For menus to be beneficial to the students,

menu options must be meaningful and logically grouped together (Dix et al., 1997, 117). Horton (2000) lists three suggestions for making a menu driven interface more effective. First, build in an index and search function so learners have more ways to find related topics (p. 174). Second, display menus in separate frames. Learners can then navigate to related topics via the menu rather than by links within the main body of the web or course pages (p. 174). Third, automate sequential navigation. Develop the software so the "next" and the "previous" buttons calculate where to go based on an easily maintained list of topics (p. 174).

Dix et al. (1997) portray the WIMP interface as an interface that contains windows, icons, menus, and pointers. It is similar to the Windows based operating system that is found on most of today's personal computers.

Point and click styles utilize a menu that students use a pointer (mouse) and click on the option that they desire to initialize (Dix et al., 1997, p.129). Horton's suggestions regarding the use of menus, such as building an index and search function, using separate frames, and automating navigation are also appropriate to this interface style.

e. Program Control Issues

There is a wide array of non-instructional control issues that must be resolved prior to students participating in a computer delivered course of instruction. These issues include directions, book marking during a lesson, finishing a lesson, and moving forward and backward throughout a lesson. Methods available for students to use when activating one of these control functions can include menus, icons, or special keys on the keyboard that initiate specific functions. Allessi and Trollip (1991) recommend using menus for such things as initial control, sequence selection, and review functions (p. 26). Allessi and Trollip (1991) further advocate saving command key usage for forward progression, backward paging, help, index, and exit functions (p. 26). While Belanger and Jordan (2000) do not discriminate between menus and command keys, they argue that learners must be provided with the ability to add, delete,

and organize bookmarks; track progress; use a review function; and the ability to generate and use practice quizzes and tests (p. 149).

Every student needs the capability to find and read the courseware directions. Allessi and Trollip (1991) claim directions are essential to the effectiveness of any computer-based lesson (p. 21). Whether directions are optional or mandatory, Allessi and Trollip argue that it is vital to ensure they are readily available (p. 21). This makes sense. If optional directions were not easy to find and use, students would quickly give up and the lesson would not be satisfactorily completed. A paper-based manual may be the best method for delivering directions to students. This manual can be saved on a server in an Adobe PDF format, and then downloaded via the Internet by students. Students will be able to more easily access and use directions in the event of software "glitches" if the directions are obtained separately and used independently from the courseware.

From a student's perspective, the ability to bookmark a spot in a lesson, leave, and then come back to it is important. Students may not have the time to successfully complete a given lesson in one sitting. No student wants to start a lesson, have to leave in the middle of that lesson, and then have to restart from the beginning again when they came back. This is a waste of time and effort. Consequently, the ability to bookmark a lesson is critical to students' attitudes toward their learning environment, and quite possibly to their successful completion of a course of instruction.

Allessi and Trollip (1991) recommend students be given the option to quit the program, return to the main menu, or continue to the next planned lesson whenever they complete a topic (p. 85). Empowering the students to decide what topic to complete next gives the students a sense of control, and improves motivation to continue using the software.

Another vital control function students need is the ability to page forward and backward throughout a lesson. Sometimes a student is very familiar with, or has already mastered, the particulars of part of a topic. The student may

want to rapidly scan through the portion of material he or she has mastery of, and the incorporation of a page forward key or icon is a good way to give this control to the student. Alternately, if a student has not understood the material over the course of several slides in a topic, it is essential to give that student the ability to go back and reexamine those slides. In this way, a student can repeatedly go through any section of a lesson until it is understood or mastered.

f. Design Evaluation

Once an organization has developed an initial design for a training program, it is best to evaluate that design. Dix et al. (1997) offer many useful ideas about evaluating designs that can be useful in determining if the initial CBT blueprint is correct. He suggests the CBT system should always keep users informed about what is happening via timely feedback. Since consistency is key, developers should verify that users do not have to wonder whether different words, situations, or actions mean the same thing. The user should not have to remember information from one part of a dialog to another and instructions should always be available. Despite the prevalence of computers, there are still many people who have a difficult time operating them (p. 414). According to Dix et al. (1997), it is also important that all CBT systems be able to help users recognize, diagnose, and recover from errors (p. 414). By verifying a CBT program is designed to satisfactorily meet these criteria, developers can help ensure a relatively smooth transition from the design phase of a CBT initiative to all subsequent phases with minimal design rework.

4. Lesson Organization and Sequencing

If a training initiative is going to be effective, it must be efficiently organized and the lessons should be properly sequenced. In other words, the effort must be properly framed. Horton (2000) describes a course's framework as the routine parts of the course that do not teach subject matter but are nevertheless an essential part of the course (page 78). Allessi and Trollip (1991), along with Horton (2000), agree that these can include, but are not limited to the following: Course announcements page, course and lesson introduction pages, learning objectives pages, learning materials, and a feedback

loop. Some authors, such as Allessi and Trollip (1991), include the course's actual instructional content within a course's framework.

a. Announcements Page

Although it may appear unnecessary to develop an announcements page if conducting training exclusively with CBT, it is still a good idea to implement. There are two basic reasons why. First, just because the training is conducted via the computer does not necessarily mean that testing is. An announcements page is a convenient method to announce quizzes, tests, and performance appraisals. Second, the instructional information on a particular compact disc may need to be changed. An announcements page on the Internet allows administrators to easily pass all relevant information regarding changes to the students.

b. Introduction

In CBT, the introductory part of a lesson consists of two parts. The first is the title page. The title page is used to attract attention, create a receptive attitude, and to indicate what the topic is about (Allessi and Trollip, 1991, p. 19). An unattractive, sloppy, or overly simplistic title page may give students an idea the presentation is going to be unattractive, sloppy, or boring, which will decrease students motivation to progress through the lesson before any learning has occurred.

The second part of the introduction is the presentation of learning objectives. As indicated previously, learning objectives indicate what the student will be able to do, say, or write at the completion of the lesson (Allessi and Trollip, 1991, p. 19). For example, a typical learning objective may look similar to, "After this lesson, you will be able to set the time on your VCR." Allessi and Trollip (1991) identify two types of learning objectives, behavioral and non-behavioral. A behavioral objective expresses the task, conditions, and performance required by the student. Reporting contact with another ship to the Captain is an example of a task routinely performed at sea. The behavior objective for this task would include the prerequisite conditions that must exist prior to starting the procedure, data to be gathered during the procedure, how to arrange the data so it becomes

useful information to the Captain, and what to say when actually making the report. Non-behavioral objectives enhance focus on both specific and non-specific aspects of a lesson. I believe using behavioral objectives in a training environment is the better organizational policy. In doing so, the students remain focused on the most important aspects of their training. Horton (2000) advocates writing the objectives in terms of what the student will do, say, or write as opposed to providing the learning objectives as teaching objectives (from an instructors point of view), which stresses the application of training in a meaningful way to the students (p. 91). Horton (2000) identifies phrases and words that are good to use, and those that are undesirable when writing learning objectives. When generating learning objectives, Horton (2000) recommends using words such as create, make, install, set-up, edit, revise, amend, start, repair, replace, diagnose, troubleshoot, organize, and write (p 91). Words that should be avoided include understand, list, give an example of, articulate, explain, describe, identify, recall, master, and differentiate (p. 91). According to Horton (2000), these words are to be avoided because they describe student performance in terms of what the instructor is teaching, not in terms of what the student must do to meet the objective.

c. Learning Materials / Instructional Information

Learning materials include books, manuals, videotapes, DVD's, CD-ROM's, and all other media that assists the student in learning. Each of the aforementioned media all have one thing in common. They each present instructional information to the student. How they do this is also important.

According to Allessi and Trollip (1991), there are four types of information that can be effectively presented to students via CBT. They are (a) verbal information, (b) general concepts, (c) rules and principles, and (d) skills (p. 44). I have reservations about the utility of teaching skills by way of CBT. Of these four types, a set of skills is the most difficult to teach via the CBT method. In order to effectively teach a new skill set, it may be necessary to teach the concepts, rules, and principles that guided the development of the skill. CBT is an appropriate and proven vehicle to present the first three types of information,

but it may not be the best mechanism to teach skills, especially if CBT is used in conjunction with on-the-job-training. From experience, it is easier to learn a new procedure, especially when it involves operating machinery, when the trainee is able to see, touch, hear, smell, and manipulate the actual equipment. As a general rule, it is best to teach from the simple to the complex. This means ideas, concepts, then rules and principles, followed by the actual procedure should be the sequence in which skills are taught.

d. Feedback Loop

The feedback loop is a very powerful learning tool educators have at their disposal. According to Stolovitch and Keeps (2003), Allessi and Trollip (2001), and Wiggins (1998), feedback to students should depend on their answers and needs to be either corrective or confirming. Wiggins (1998) states corrective feedback will compare current student performance to what a successful outcome is, which focuses student attention on how to improve (p. 49). Stolovitch and Keeps (2003) argue confirming feedback is used as a reward for answering questions correctly, and that frequent and specific feedback has been demonstrated to improve performance (p. 67).

5. Instructional Presentation

There are three basic aspects to a CBT delivered presentation I will examine in this section. They are the screen organization and use of graphics; text, language, and grammar; and mid-topic questioning techniques. Screen organization centers around the layout of the screen during a lesson. Additionally, basic guidelines for the use of graphics will be presented. The proper use of language and grammar are essential to the development of a high-quality training program. The way in which textual information is included in a presentation can affect learning. Simple guidelines for presenting text will be explained. An important aspect to any training program is the use of questions throughout the lesson to determine student comprehension and the associated feedback to the students about their performance. Successful questioning techniques will also be examined.

a. Screen Organization

According to Berry (2000), research suggests that visuals (web pages or CBT pages) are equivalent to lengthy text in their ability to effectively communicate (p. 48). Leflore (2000) details three laws that are important to know if developing CBT software. By understanding the principles encompassed by these laws, developers can begin to place instructional objects into courseware in ways that are very beneficial to the students they are training. The first is the Law of Proximity, which states it is easier for learners to understand that different text or graphic elements go together if these elements are placed close together (p. 103). For example, the text that describes a figure or illustration should be placed close to that illustration. The second law Leflore (2000) describes is the Law of Similarity (p. 103). This law states that people will group things together that look similar (p. 103). For example, if elements in a graphic are all of the same style, the graphic will be seen, or perceived, as a whole (p. 103). The third law Leflore (2000) mentions is the law of Closure. Leflore (2000) states individuals will try to interpret incomplete graphics or text based upon past experience (p. 104).

Leflore (2000) also provides a set of six Gestalt Theory guidelines appropriate for following when constructing a CBT delivered course. They are:

(a) When designing web-based instruction, make sure that the background does not interfere with the clarity of the information presented in the foreground (p. 104).

(b) Use simplified graphics to introduce new material. If the concept requires complexity, start simple and gradually add in the complexity (p. 104).

(c) Place related information together on the screen so the learner will automatically grasp the information together as a unit rather than as separate elements (p. 104).

(d) Use color, animation, flashing, or other means to draw attention to key phrases in text or areas in graphics (p. 104).

(e) Ensure text and graphics are complete, so the student does not have to spend energy “making” or “creating” meaning (p. 104).

(f) When introducing a new topic, vocabulary unique to the content should be introduced by using common terms. Avoid using jargon until after all the new terms have been introduced (p. 104). As a matter of style, it is important that courseware developers avoid using acronyms without first explaining them (Allessi and Trollip, 1991, p. 43).

It is disconcerting to students when they must “scroll” through lengthy text. According to Allessi and Trollip (1991), it is hard for people to distinguish between old and new information when it is moving (p. 35). Therefore, it is important to limit the amount of textual information that is presented to no more than one page at a time to avoid making the students scroll through text. Allessi and Trollip (1991) also recommend enclosing the primary text in a box, for emphasis, when using both graphics and text on the same page. The students’ attention will then become focused on the most important information (p. 38).

b. Graphics

Graphics are very useful tools that can be used for the presentation of instructional information, presentation of analogies, or as cue’s for student action. Belanger and Jordon (2000) detail two types of graphical animation: bitmapped or object-oriented. A bitmapped image is drawn, and motion is generated through showing progressive movement in frames per second (FPS). Full motion video is shown at 30 FPS and a minimum of 10 FPS is required to avoid a “choppy”, or strobe effect (Belanger and Jordon, 2000, p. 130).

Complex graphics can easily confuse students unfamiliar with the material. Graphics that contain a lot of information should be, if possible, broken down into smaller parts and presented sequentially (Allessi and Trollip, 1991, p. 40). Allessi and Trollip (1991) also contend that graphics should always be presented with their associated text because changing back and forth between an illustration and its textual description makes comprehension more difficult for

the student (p. 40). According to Williams, Paprock, and Covington (1999), designers can also help the students by using graphical displays that are “off-centered”. This forces the students to scan the whole screen and not just focus on the center of it (141).

1. Color. The use of color can add breadth to any presentation, increasing student interest and motivation. For example, using different colors to represent segments of a pie chart can be an effective way to help students quickly distinguish between each segment of the graph. Using a colored screen may indicate to students that an action must be taken. If the computer is awaiting student input, the background color of the screen could be yellow. The screen could flash red or green depending on whether a student answered a question correctly. Although the use of color is encouraged, there are a few rules to be followed when using color in a CBT environment.

Allessi and Trollip (1991), and Williams, Paprock, and Covington (1999) agree that if multiple colors are used on the same screen, they should contrast. Additionally, red and blue should be used sparingly since they are not perceived as well as colors in the middle of the visible spectrum, such as yellow and green. Dix et al. (1997) add that the colors used should correspond to common conventions and user expectations (p. 115). This means red should mean “wrong”, or “stop”, whereas green should mean “correct”, or “go”. Dix et al. (1997) also argue if color is used as an indicator, it should not be the only cue given to the student. For example, if a course used a colored screen to cue a student that a question is answered correctly or not, it should also include the words “Correct”, or “Wrong” within the colored screen as a second cue to the student.

c. Text, Language, and Grammar

There are a number of factors that must be considered when presenting textual information via a computer. These include the characteristics of the text itself, textual quality, along with language and grammar.

Williams, Paprock, and Covington (1999) offer a set of guidelines appropriate for the way text should “look”, or its characteristics, when using CBT

to present information. Williams, Paprock, and Covington (1999) state that since the art of turning verbal information into visual communications involves working with space, text, fonts, and visual relationships, it is best to use a simple bold "Sans Serif" fonts (p. 139). The bold type makes the letters sharper. Allessi and Trollip (1991) and Williams, Paprock, and Covington (1999) believe it is best to use a mixture of capital and lowercase letters, and avoid using all capital letters.

For best readability, Williams, Paprock, and Covington (1999) recommend using a maximum of seven lines in height and seven words in length per line on a given presentation page (p. 139). Using these guidelines forces educators to be brief and concise, a trait often expected of their students. According to Allessi and Trollip (1991), all CBT presentations should say just enough to teach what is desired (p. 43).

The quality of text is an important concept. Not only must the font be readable and the text brief, but it must precisely convey the main ideas of the lesson so that the learning objectives will be met. Pronouns with unclear referents should not be used. Additionally, more than one word should not be used to refer to the same thing and the use of the same word at different times to mean different things should be avoided (Allessi and Trollip, 1991, p. 43).

It should go without saying that CBT presentations should be inherently flawless with respect to spelling, grammar, and punctuation. This is not always an easy task considering that brevity is also considered a necessity. The key to enhancing student learning and comprehension is consistency throughout the course of instruction.

d. Mid-Topic Questioning Techniques

According to Allessi and Trollip (1991) and Gronlund (1998), questions asked during a lesson serve many functions. Mid-topic questions help keep the student attentive, provide needed practice, encourage deeper processing, assess student recall and understanding, and provide a basis for lesson sequencing. Each of these is an appropriate reason to include questioning within the framework of each topic. I recommend asking questions

about material about to be taught as well as material that has already been taught. Asking questions about material yet untaught will focus the student's attention on the material he or she is about to learn. Questioning students about material already presented will assist in verifying the learners' comprehension.

It can be difficult to know how much questioning should be used during a lesson. Allessi and Trollip (1991) argue that it should occur frequently because the more a student interacts with the program, the more attention will be maintained and more learning will be facilitated. Although I agree frequent questioning will improve attention, I believe too much questioning can lead to student frustration. Too many questions during a lesson may be interpreted as unnecessary interruptions that distract and anger students. I recommend using caution when placing questions in the middle of a presentation. Having been an enlisted naval instructor for nearly four years, I have come to believe it is better to ask a few questions during the lesson to maintain the students' attention and then ask deeper thought provoking questions at the end of each topic. This technique worked very well for me in the classroom, and I believe it would work just as well in a CBT environment.

6. Student Testing

Assessing student performance is a vital aspect of all training programs. Assessments can be summative or formative. Summative assessments are completed at the end of a course whereas formative assessments are used to monitor progress throughout the course.

a. Testing Schemas

There are three basic testing schemas. In the first, the computer grades students' answers. Horton (2000) argues this technique has two advantages. Evaluation is immediate and the computer is nonjudgmental (p. 277). However, Horton (2000) and Allessi and Trollip (1991) report that because the computer is limited in the types of answers it can grade, teachers can only ask simple forms of questions. The second schema utilizes the student's coworkers or managers to grade exams. According to Horton (2000), the disadvantage to this approach is coworkers may not be available or may not

have the expertise required to evaluate the learner (p. 277). The last schema calls for the student's answers to be transmitted to the instructor for grading. Because instructors can spot any subtle mistakes and grade appropriately, there is no limit to the types of questions that can be asked of students (Horton, 2000, p. 277).

b. Test Construction

Ciavarelli (2003) outlines four rules to follow when building tests. They are:

(1) Examination content must be based upon the learning objectives (p. 14).

(2) Performance requirements for the examination must be consistent with the learning objectives (p. 14)

(3) Examination instructions must be clear (p. 14).

(4) Feedback regarding the examination must be timely, constructive, and relevant (p. 14).

c. Remediation

Remediation is the follow-on presentation of the same instructional material to a student who did not meet the necessary standards on an examination or performance review. Allessi and Trollip (1991) state that remediation can occur in the form of repeating information already seen or the form of providing information in more detail (p. 77). This can include giving the student more examples, pictures, sample problems, or practice problems.

C. EVALUATIONS

Evaluation is essential to any educational endeavor. There are two fundamental types of evaluations: course (or program) evaluation and student evaluation. Both are necessary, since one type of evaluation examines whether the right material was taught to the students in an effective and efficient way, and the other examines whether the students learned the material sufficiently well enough to conclude the learning objectives were met. As can be seen, evaluations determine the effectiveness of any training program.

Authors that write about evaluations often quote Kirkpatrick. Many consider him a pioneer in the field. Kirkpatrick (1998) argues, and Dix et al. (1997) concur that there are three primary reasons to evaluate training. First, to justify the existence of the training department by showing how much it contributes to an organization's objectives and goals. Second, evaluations are used to decide whether to continue or discontinue a training program. Third, evaluations are used to gain information on how to improve future training programs.

Whatever type of evaluation is being constructed, it needs to be contextually relevant (Moskal and Dziuban, 2001, p. 161). There are guidelines to be followed to ensure evaluations generate valuable and useful information to be used to make the training program better. The expense of time and money to perform an evaluation is wasted if the correct information is not being collected.

1. Training Objectives

Nearly half a century ago, Bloom (1956) identified three educational domains. They are the cognitive domain, the affective domain, and the psychomotor domain (p. 7). Learning objectives within the cognitive domain focus on recall of knowledge and the development of intellectual skill (p. 7). Learning objectives within the affective domain focus on changes in interest, attitudes, and values (p. 7). Learning objectives in the psychomotor domain focus on manipulative, or human motor-skills (p. 7).

Traditionally, student performance within each of these domains is evaluated differently. Performance in the cognitive domain is usually measured through tests and papers. In a traditional college classroom this equates to a midterm, a final exam, and a moderately sized research or opinion paper. It is harder to evaluate students across the affective domain because it is harder to objectively evaluate a student's attitudes. Teachers attempt to achieve this by taking attendance and giving a grade for in-class participation. Performance based tests, or demonstrations, are normally used to evaluate students' psychomotor skills.

a. Bloom's Taxonomy

Bloom (1956) developed a taxonomy, or method of classifying educational objectives. Bloom (1956) defined an educational objective as the explicit formulations of the ways in which students are expected to be changed by the educational process (p. 26). Each category that is presented, builds on the previous one. A student can be thought of as moving through these categories, from one to another, as knowledge and intellectual skill improve. Additionally, the way questions are worded when assessing student achievement varies from one objective category to the next. Bloom's (1956) taxonomy of objectives includes the following categories: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Knowledge is remembering, by recall or reorganization, some idea or phenomenon with which the student has had experience in the educational process and it is basic to all other ends or purposes of education (Bloom, 1956, p. 18). Basic questions that test recall are often used to assess knowledge. For example, "A destroyer is a type of _____?" would be an appropriate question if testing in the knowledge domain.

Comprehension is related to behaviors or responses that represent an understanding of the literal message contained in a communication (Bloom, 1956, p. 89). Asking students to translate or interpret ideas are effective means to assess student comprehension. A question asking students to illustrate the concepts depicted on a chart or other graphic would be an effective way to test comprehension.

Bloom (1956) defines application as the illustration of a task or idea that requires the comprehension of a method, theory, principle, or applied abstraction (p. 120). Asking a student to explain in detail the underlying reasons why a modern ship ran aground after providing the student with a set of facts about the case in question is an example of how to assess student capabilities within this domain.

The category of analysis is similar to application. Analysis is the breaking down of the given material into its constituent parts and detection of the relationships of the parts and the way they are organized (Bloom, 1956, p. 144). Giving students an article to read and then asking questions about the article, like, "Which of the following best describes…" or "The argument that was presented was flawed because…" is effective at measuring students' analytical proficiency.

Bloom (1956) describes synthesis as the putting together of elements and parts so as to make a whole (p. 162). He argues that it is a combining parts and elements in such a way as to constitute a pattern or structure not clearly there before (p. 162). Conducting research and then developing a template for analyzing CBT could be considered an exercise in synthesis. Requiring students to set a poem to music, write a simple melodic line, or write a composition with a single tonal base are all examples of testing students within the synthesis domain (Bloom, 1956, p. 179).

Bloom's last objective is evaluation. Bloom (1956) defines evaluation as making judgments about the value, for some purpose, of ideas, works, solutions, methods, or materials (p. 185). According to Bloom (1956), evaluation involves the use of quantitative and or qualitative criteria as well as standards for appraising the extent to which particulars are accurate, effective, economical, or satisfying (p. 185).

These domains are as important today as they were fifty years ago. With respect to training, organizations know to what extent they want an employee to be trained in a specific job. Some employees only need have a simple understanding, or comprehension, of their job tasks. A gas station attendant, for example, may only need to know how to pump gas, check the oil, and clean automobile windows. Other employees need to be able to assimilate obscure and seemingly unrelated information and make a decision that may impact the organization for years to come. It is likely that these employees will receive training that will enhance their ability to function in the higher (synthesis

and evaluation) domains. It is important that organizations build mechanisms into their courses of instruction that verify (1) that the course's learning, or educational, objectives are in agreement with organizational goals, and (2) that the students' performance after training exceeds the standards set by the educational objectives.

This is not an easily accomplishable task. Kirkpatrick (1998) contends that evaluating the results of training is very difficult (p. 60). "What is the amount that quality or productivity improved as a result of training?" or, "What is the amount training contributed to profits?" are questions that many organizations have historically been unable to answer (Kirkpatrick, yr, p. 60).

However, this does not mean that it is impossible to validate training objectives. One method, although time consuming and rigorous, that has been proven successful by Housel and Bell (2001) in answering many Kirkpatrick's questions. It is the Knowledge Value Added (KVA) method. Organizations that properly utilize KVA are able to determine if their training, and specifically, what training is contributing to improved or decreased revenues. Although very important, it should be noted that this is just one dimension of course or curriculum evaluation.

2. Evaluation Design

According to Bloom (1956) and Renshaw and Taylor (2000), the design and evaluation of computer-based instructional materials should be accomplished with appropriate memory models and learning theories as a reference. Despite the importance of and vital need to conducting evaluations, there is no universally agreed upon standards or methods for their performance. Some, like Wiggins (1998) seem to advocate more of an emphasis on student evaluations, while others like Kirkpatrick (1998) seem to focus on program evaluations. Despite the differences in their approaches, the goal remains the same: ensuring that the learning objectives are met.

Hall (1998) suggests that three themes should guide the development of any evaluation model. First, Hall (1998) contends that an overriding direction,

taking into account learners, contexts, and goals, should be meticulously identified as a first step (p. 138). Next, Hall (1998) argues that proper design is a matter of finding the proper balance between elements of simplicity and complexity (p. 138). In other words, do not overdo it. Last, Hall (1998) states that evaluations and assessments must be part of any program design process because without evaluations, the designer will never become aware of how effective a training program is (p. 138).

Wiggins (1998) offers six criteria that should be examined during an evaluation. According to Wiggins (1998), all assessments should be:

(a) Credible to all stakeholders (p. 111).

(b) Useful, helpful to teachers, students, and administrators (p. 111).

(c) Balanced in the use of assessment methods, to provide a rich, defensible, and feasible profile of achievement (p. 111).

(d) Honest, yet fair (p. 111).

(e) Intellectually rigorous and thought provoking; focused on core ideas, questions, problems, and knowledge (p. 111).

(f) Feasible in terms of resources, logistics, politics, and redeployment of time for collaboratively designing, debugging, using, evaluating, and effectively reporting student work (p. 111).

Compare these student-focused criteria against a set of program-centered criteria. Kirkpatrick (1998) contends that there are eight broad factors that should be considered when performing an evaluation of a program. They are:

(a) To what extent does the subject content meet the needs of those attending (p. 17)?

(b) Is the instructor the one best qualified to teach (p. 17)?

(c) Does the leader use the most effective methods for maintaining interest and teaching the desired attitudes, knowledge, and skills (p. 17)?

(d) Are the facilities satisfactory (p. 17)?

(e) Is the schedule appropriate for the participants (p. 17)?

(f) Are the aids effective in improving communication and maintaining interest (p. 17)?

(g) Was the coordination of the program satisfactory (p. 17)?

(h) What else can be done to improve the program (p. 17)?

It is obvious that each of the previous two lists were designed to evaluate different aspects of a course of instruction. The objectives in each case, however, were the same, to ensure that the students learned what the instructors intended them to. To argue for the primary use of one of these two approaches over the other is counterproductive. Both types of evaluations are essential to ensuring not only that the students are learning, but that they are learning the right material. I agree with Belanger and Jordon's (2000) argument that the key consideration for the success of any distance-learning environment is whether or not, and to what degree, the learning objectives are being met (p. 14).

3. Pedagogical Evaluation

There are many evaluation methods, or models, available for use. Some organizations hire other firms to conduct training evaluations, while others develop a set of in-house guidelines. Some approaches to evaluation are simple, and some are very complex. Some companies even prefer to use a multifaceted approach. What is clear is that the approaches, methods, evaluators, and scoring rubrics vary greatly.

Belanger and Jordon (2000) report that determinants of program success can be grouped into the four categories of institutional characteristics, learner characteristics, course characteristics, and distance learning characteristics (p. 187). Institutional characteristics factors include institutional objectives, delivery mechanisms, and support structures (Belanger and Jordon, 2000, p. 187).

Learner characteristics include the factors of motivation, desire to excel, and self-sufficiency (Belanger and Jordon, 2000, p. 188). The course characteristic factors include group project, final paper, knowledge based or

performance-based criterion (Belanger and Jordon, 2000, p. 188). Distance learning factors consist of the type of technology and learning environment.

This structure provides a decent framework for building a comprehensive evaluation template from. This model would be very useful in making baseline predictions about the future success or failure of a training program. Upon examination, this model does not define any of the factors that fall into the four categories. Just as it is important that organizations adequately define their educational objectives, it is also important that organizations precisely define the measurement categories, factors, and rubrics that will be used to evaluate the training program.

Parikh and Sameer (2002) describe an empirical model for program evaluation that is similar to Belanger and Jordon's. This model also has four dimensions. Parikh and Sameer (2002) list them as content, technology, interface, and functionality (p. 35). The content section of this model measures the characteristics of the information provided by the system to the users, how precise the information is, what is its value, and if it meets the users' needs (Parikh and Sameer, 2002, p. 35). The technology category is used to determine whether the organization is utilizing appropriate technologies to deliver the right information at the right time (Parikh and Sameer, 2002, p. 35). Interface examines whether the system is easy to learn and user friendly (Parikh and Sameer, 2002, p. 35). Parikh and Sameer (2002) state that evaluators would use this section to verify that the screen layout is appropriate, instructions clear, and information is presented in a useful format (p. 35). Functionality measures the practicality as opposed to the attractiveness of the system (Parikh and Sameer, 2002, p. 35).

4. Instructional Evaluation

All instructional activities need to be assessed. It is possible students are being taught old, or outdated materials. Unfortunately, it is possible that an instructor, even though an expert, may not be very good at teaching. Tests can be biased toward a particular race or gender. If organizations did not evaluate

the various aspects to instruction, these potential problem areas might never be discovered. If never discovered, they cannot be corrected.

Gronlund (1998) believes assessments allow organizations to evaluate the effectiveness of three parts of the instructional process. Organizations can ascertain to what extent instructional objectives were realistic, evaluate whether methods and materials of instruction were appropriate, and determine how well the learning experiences were sequenced (p. 11). Gronlund (1998) offers a set of guidelines to follow when performing instructional assessments and analyzing the results:

(1) Organizations must have a clear conception of all intended learning outcomes (p. 18). What types of knowledge, understanding and application does the organization want students to gain and what evidence is the organization willing to accept as proof that the students have achieved to that level (p. 18).

(2) The organization should use a variety of assessment procedures to verify student achievement (p. 18). These can include tests, quizzes, surveys, performance assessments of teachers and students, or a combination of these methods (p. 18).

(3) The instructional relevance of the procedures must be considered (p. 18). Consider what happens if a student completes a CBT lesson, but the instructional material only covered three of the five learning objectives. Gronlund (1998) argues, and I agree, the instruction has lost relevance because the learning objectives, instruction, learning tasks, and assessment procedures are not in close agreement. There is hardly a greater “instructional sin” than telling students that they will be required to learn material to a organizationally defined standard and then not allowing them to meet that standard because not enough information, or the wrong information, was presented.

(4) Specifications of criteria for judging successful performance must be known and published (p. 20). Without clearly defined and published grading criteria, it is easy to demotivate students. For example, assume a class of students is required to complete an essay, but they have not been told what the

grading criterion is going to be. When the papers are handed back, the students that did not receive the highest grades will not only wonder if the papers were graded fairly, but will also lose motivation and interest because they are unsure what how to write an “A” paper next time.

(5) Feedback must emphasize the strengths of performance and any weaknesses that need to be corrected (p. 21).

(6) A comprehensive grading and reporting system must be in place (p. 21). Gronlund (1998) infers that letter grades should be eliminated (p. 21). Letter grades help educational institutions separate good performers from poor ones, and have value in public education. However, in an organizational training environment, letter grades mean very little. Employees would be better served if they were provided specific, objective, relevant, and non-biased feedback that praised their strengths, identified their weaknesses, and concluded by offering suggestions for improving performance. Furthermore, it this feedback would be very valuable if it were given many times throughout a lengthy course of instruction, as opposed to once at the end of the class.

D. COMPREHENSIVE MODEL FOR THE EVALUATION OF CBT

This CBT evaluation framework consists of two sections. This first section is Pedagogical Evaluation. The second section is Instructional Evaluation. Each section consists of four functions. The Pedagogical Evaluation section contains a Program Operation function, an Instructional Presentation function, an Assessment Function and a Feedback function. The Instructional Evaluation section consists of a Course and Learning Objectives function, a Core Curriculum function, along with Assessment and Feedback functions. Figure 4 displays a representation of this evaluative framework. Two sets of questionnaires were developed for each section. One set is designed for developers and program evaluators to use, the other set is designed to gather information from students. Appendix A contains all of the questionnaires.

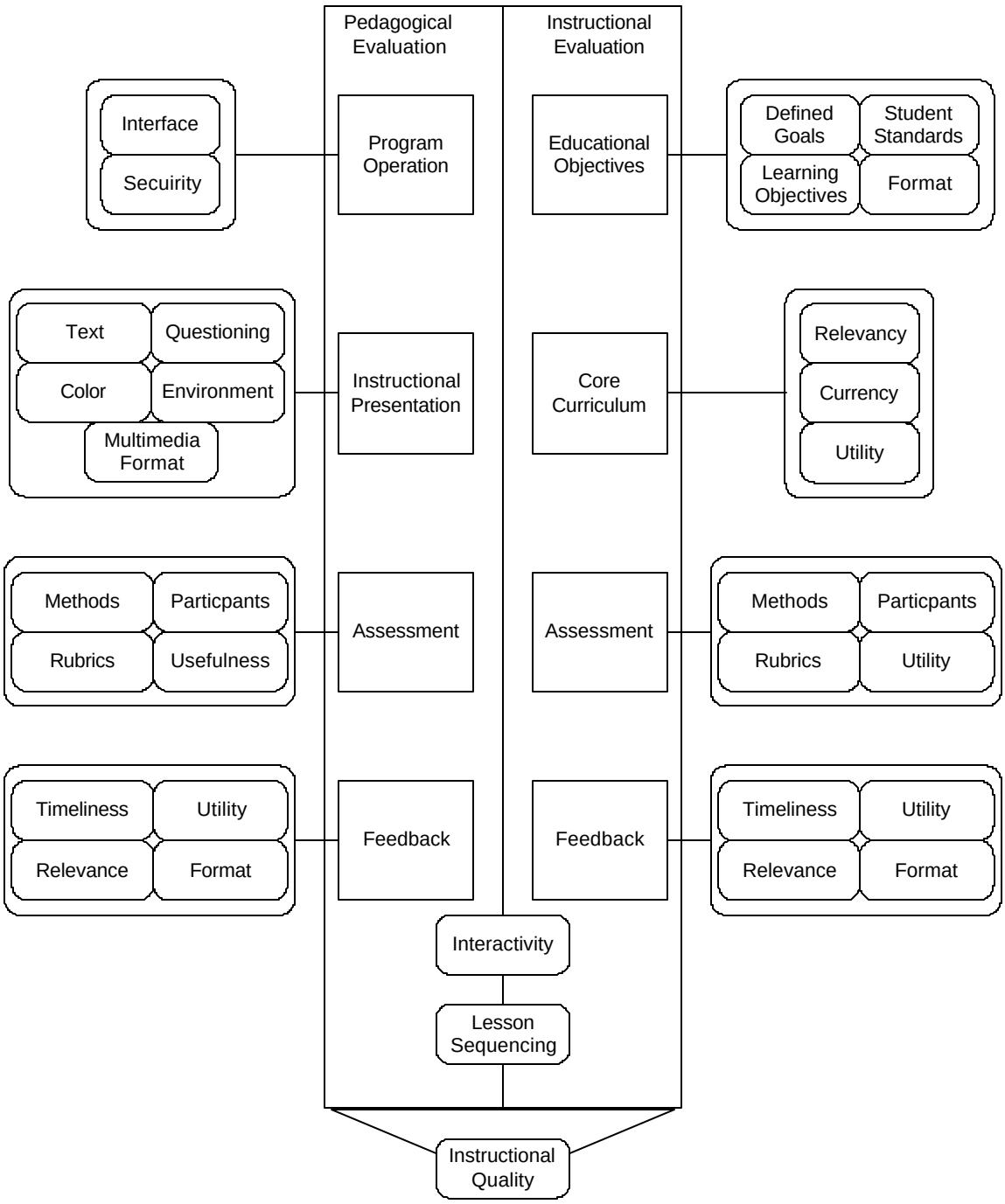

Figure 4. CBT Evaluative Framework

Two elements, Interactivity and Instructional Sequence, overlap the boundaries of the two main sections. These elements fit best within the Pedagogical Evaluation section's Instructional Presentation function, but cannot be properly evaluated without taking into account the Educational Objectives function's learning objectives and the instructional content of the Core Curriculum.

The Instructional Quality element assesses the overall quality and effectiveness of the CBT initiative. The strengths and weaknesses of the Pedagogical Evaluation and Instructional Evaluation sections are compared and the instructional effectiveness of the CBT initiative is determined. In other words, it is a gage of how well the CBT courseware meets organizational training objectives through the proper presentation, monitoring, and assessment of instructional content, and how well feedback is provided to both the organization and its students.

1. Pedagogical Evaluation.

This section of the evaluation framework will assess the various aspects of CBT that are not associated with the information that is taught and the way information is tested throughout the student population. The information gathered using the functions in this section will enable organizational leadership and those who develop CBT programs to effectively identify the strengths and weaknesses inherent in the techniques their CBT software programs' are installed, used, and presented to students. Once deficiencies are identified, organizations can, based upon their needs or budgetary constraints, implement procedures that will eliminate or minimize the identified weaknesses.

a. Program Operation

The Program Operation function examines the software's interface and amount of control that each learner has while using the tutorial.

1. Interface. The interface between the student and the computer is very important. It determines what the student is going to look at on the computer screen while navigating through each lesson. This element

critically examines screen organization, student control during training, ease of installation and ease of use.

2. Security. This element assesses whether students' personal information, test scores, or performance evaluations are protected from intrusion, tampering, or theft.

b. Instructional Presentation

The Instructional presentation function assesses the quality of CBT instruction. This function will not evaluate the instructional content of a lesson; only how well it is presented.

1. Interactivity. This element evaluates whether a CBT lesson is interactive. Although the objective of this element is not to evaluate instructional content, whether a lesson contains an appropriate amount of interactivity is determined in a large part by the instructional content's length and complexity.

2. Lesson Sequencing. The lesson-sequencing portion of this section assesses whether or not lesson topics are properly sequenced. Although the objective of this element is not to evaluate instructional content, whether a series of modules or lessons are correctly sequenced is largely determined by lesson content and the principle of teaching from simple to complex.

3. Multimedia Format. This element evaluates whether incorporated graphics, animations, cartoons, video, and audio, is being used correctly.

4. Color. This element evaluates whether the use of color has been implemented correctly.

5. Text. This element verifies that text has been properly laid out and spaced, and that the presentation is grammatically correct at an appropriate reading level.

6. Questioning. This element assesses whether appropriate questioning techniques have been implemented throughout the lesson.

7. Environment. This element analyzes the suitability of the students' learning environment while using CBT.

c. Assessment

This function of the pedagogical evaluation section evaluates how the organization conducts assessments.

1. Methods. This element evaluates whether organizational assessment methods are defined and used.

2. Rubrics. In this instance, a rubric is the standard with which each function of the CBT program will be evaluated. This element evaluates whether rubrics for each "area" the organization will assess have been properly defined.

3. Participants. This element determines if all of the evaluation participants, along with each one's role in the evaluation has been defined and promulgated.

4. Usefulness. This element assists in evaluating whether or not the information collected during an assessment is useful to the organization.

d. Feedback

Feedback regarding the pedagogical effectiveness of any organizational training initiative is critical for the success and continued improvement of that venture. This function evaluates whether the feedback to the organization regarding their CBT's pedagogical effectiveness is timely, relevant, and useful.

2. Curriculum Evaluation

The Curriculum Evaluation section of this model will analyze the course content for relevancy, correctness, and usefulness to both the organization and those undergoing the training.

a. Learning Objectives

This element of the model will verify several things. First, that the organizational goals with respect to a particular training program are defined. Second, it will determine if the training program's learning objectives have been derived from the program's stated goals and if the students' performance

standards were derived from the learning objectives. Third, it will verify that the learning objectives are presented in the CBT program in terms of student performance.

b. Core Curriculum

This function will verify that the instruction that the students receive is relevant, current, and useful to the students. It will also verify that as a result of this instruction, students are able to meet or exceed all required performance standards.

c. Assessment

This function of the pedagogical evaluation section evaluates how the organization conducts assessments.

1. Methods. This segment evaluates whether assessment methods for each lesson are defined and used.

2. Rubrics. This segment evaluates whether rubrics for each test or performance assessment have been properly defined.

3. Participants. This segment determines if all of the participants, along with each one's role in the test, quiz, or performance assessment has been defined and promulgated.

4. Usefulness. This segment assists in determining whether or not the information collected tests and performance evaluations are useful to the organization.

d. Feedback

Feedback regarding the instructional effectiveness of any organizational training initiative is essential for the success and continued improvement of that venture. This function evaluates whether the feedback to the organization and the students regarding the CBT instruction and testing is timely, relevant, and useful.

3. Conclusion

Use of this template and its associated survey sheets found in Appendix A will allow evaluators to conduct comprehensive assessments of their CBT programs. The survey sheets will be used to conduct an evaluation of the

reengineered CBT Surface Warfare Officer Division Officer course of instruction. The result will be an accurate assessment of the course's cognitive and pedagogical strengths and weaknesses.

With minor modifications to the pedagogical evaluation section of template, it could be effectively used to evaluate the strengths and weaknesses of traditional classroom instruction. Specifically, computers differ from humans in the way in which they present information. Since they present instructional materials differently, different criteria for conducting that portion of an evaluation is required.

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IV. ANALYSIS

This analysis is being conducted to fulfill two objectives. First, it acts as a proof of concept that the evaluation framework presented in the previous chapter works. Second, it depicts an accurate snapshot of the SWOS Division Officer at Sea Training Initiative at the present time. Since its inception in January 2003, very few, if any junior officers have completed this training initiative and earned their Surface Warfare Pin. This is to be expected since the majority of newly accessioned officers just joined the fleet in June and July of 2003.

A. DATA COLLECTION METHOD

1. Participants

Officers stationed aboard ships homeported in San Diego, California completed the surveys in August 2003. 17 Ensigns completed the student questionnaire and four Training Officers completed the supervisor survey. These officers were promised complete anonymity in exchange for their honesty in filling out the surveys. Consequently, ship types, names, and hull numbers are omitted from this report. Small group discussions were held one each ship immediately after the surveys were completed.

2. Survey Instruments

Two surveys were generated to assist an evaluator assessing a CBT program using the framework developed in chapter III. One survey is tailored for course administrators and one for students. The survey questions were generated through multiple means. Questions were developed based upon the literature review and the principles discussed in Chapters II and III. Dr. Anthony Ciavarelli, an expert in the field of organizational training who teaches at the Naval Postgraduate School, Monterey, also contributed questions. These questions started with a baseline survey assessing the quality of online instruction derived from Ciavarelli (2003). Several questions are worded in such a way as to only be applicable to students learning in a shipboard environment, but with minor modifications, could easily be asked to students in any CBT learning environment. Each of the two surveys had three sections. Section one

asks basic background information. Section two presents multiple statements and asks students to indicate whether they agree or disagree with the statement. A Leikert scale from one to five is used in this section. Section three asks students to provide short essay answers to multiple questions. A complete analysis of each segment in the Evaluation Framework will not be provided. Instead, areas that have identified strengths or weaknesses will be discussed in depth. Complete survey data is provided in Appendix B.

B. TRADITIONAL CLASSROOM SWO TRAINING

The curriculum that was used in the classroom to train Ensigns designated to become Surface Warfare officers was converted, in its entirety, to a computer-based training program that is now loaded onto computers from compact discs. In order to effectively determine whether the new teaching method is as effective as the one it replaced, an overview of the strengths and weaknesses of the historical classroom training program is necessary.

Historically, the Surface Warfare Officers School, Division Officer Curriculum (SWOS DOC) made extensive use of the classroom environment to train newly commissioned Ensigns who were to be permanently assigned to the Navy's Surface Warfare community. The Surface Warfare classroom curriculum structure has been modified several times over the years, but the information taught to those who received the training remained, for the most part, constant.

Instruction typically began at 0800 and usually concluded near 1600. Each fifty minutes of instruction ended with a ten-minute break. Students could expect to receive a daily lunch break that would last between thirty minutes and one hour, usually between 1100 and 1200. The students' daily routines were typical for most naval personnel, both officer and enlisted, who have received formal classroom training during the past twenty years.

1. Core Phases of Instruction

The Surface Warfare Officer School's website states the Surface Warfare curriculum was designed to prepare newly commissioned Ensigns, enroute their first tours as division officers afloat, to stand in port and underway watches, and to manage the administrative duties of the division officer afloat. The curriculum

was divided into three phases: Core Phase I, Core Phase II, and Billet Specialty Training. Core Phase I consisted of eleven weeks of operations and combat systems training, Core Phase II consisted of six weeks of platform specific engineering training, and Billet Specialty Training was comprised of three to six weeks of tailored operations, combat systems and engineering training specific to the trainee's prospective shipboard billet.

The Core Phase I curriculum was divided into units. These units were subdivided into modules, which were then broken down further into topics. It is the topics that were taught in the classroom. Including tests, quizzes, and reviews; the Core Phase I curriculum had 186 topics that were taught. Appendix C contains a listing of these topics taken from Intelligent Design System's, Inc.'s (IDSI) Final Report.

Core Phase II was divided into six units. Course content varied; depending on the class of ship the student will be going to. For example, a student with orders to an Oliver Hazard Perry class frigate (FFG) would receive instruction that covers the basics of a gas turbine propulsion plant and a student with orders to an Austin class Landing Platform Dock (LPD) would receive instruction in basic steam propulsion.

Billet Specialty Training was comprised of one or more service schools that provided the junior officer with the basic information that he or she must know in order to satisfactorily perform their assigned jobs once they arrive aboard their first ship. For example, a prospective frigate Combat Information Center Officer (CICO) is usually also the ship's Electronic Warfare Officer (EWO). This officer would first receive a week's training in CICO School, followed by a week of training in EWO School. At the completion of this training it is assumed that the Ensign possesses enough basic knowledge about the duties and responsibilities of the job that he or she will be able to immediately perform adequately in that role with minimal supervision.

It is important to remember that although it is difficult to remember all of the information presented in a six-month course of study, the information that this

curriculum imparted is important because it sets the knowledge foundation on which the new officer will build over the course of a military career. Once newly commissioned officers reported aboard their first ships, further training drew out and reinforced what was learned at SWOS. Additionally, SWOS presented newly commissioned officers with all of the information required by the Personnel Qualification Standards (PQS) to successfully qualify to stand the two watch stations that are needed to earn the Surface Warfare Pin: Combat Information Center Watch Officer and Officer of the Deck Underway. SWOS, however, did not provide the practical experiences necessary to adequately apply this knowledge, and subsequently qualify to stand these watches.

2. Test Demographics

Approximately ten years of historical tests scores, forty classes and over 5000 students, were analyzed and the outcomes consolidated. Although summarized here, appendix C contains the detailed tabulated results. On average, each class contained 183 students. Students were required to achieve relatively high scores to pass an exam. To pass the Rules of the Road test, students must have scored at least a ninety percent. Eighty percent was required to successfully pass all other exams and quizzes. Historically, the Navigation module proved to be the toughest to successfully pass. This module had two tests. On average, 33 students (18 percent) failed the first exam and 38 students (21 percent) failed the second one. This module also contained a graded practical that roughly 84 students (46 percent) in each class failed. Students also had historical difficulties passing the Rules of the Road and Combat Systems tests. Both of these exams had historical failure rates above ten percent.

As it turns out, unexpectedly, when asked in a survey by IDSI to rate the importance of each of the topics at SWOS, Surface Warfare officers 15 highest ranked topics are contained in the modules that have the highest failure rates among students. A table summarizing the results, which is published in IDSI's Final Report is included in appendix C subsection A.

3. Effectiveness of the Curriculum

Research shows that in many instances, students view their teachers, not their textbooks, as the primary source of information. This is true, in part, due to the fact that students believe that they can rely on their teacher to develop new concepts sufficiently well that the associated test can be passed without reading the book (Nix and Spiro, 1990, p. 110). It is possible that this strategy served students well enough in high school and college, but it may be inadequate to facilitate acceptable learning transfer when a student is faced with internalizing extensive quantities information that is passively learned over a shorter periods of time.

Remediation for students that failed an exam was carried out through a mandatory study program. These students were required to study within the schoolhouse for an arbitrarily designated period of time each week, typically 20 hours. This studying was done on the students' time after normal working hours. This process was used by the school as a necessary motivational tool for improving study habits and ultimately, retained knowledge. Since the school experienced a very low attrition rate, can the remediation process can be classified as a success. This approach appears to have helped students prepare for and pass their next exam, but it did not necessarily enable them to successfully use that knowledge, or several skill sets taught at SWOS, when they first arrived aboard their ships.

In its final report to the Chief of Naval Education and Training, Intelligent Decision Systems, Inc. (IDSI) posted the results of a survey that attempted to gain insight into what fleet officers thought were the core competencies required to be a successful division officer. The survey asked, "What competencies do you believe to be most necessary for a division officer to be effective?" The survey also asked, "From your experience, what competencies are most often lacking in SWOS graduates?" 22 of 55 (40 percent) of the respondents listed as a most often lacked competency at least one of the items that they listed as most necessary for division officer success. Comments included such things as administrative programs, customs and courtesies, naval platforms and their

missions, seamanship, communications, rules of the nautical road, chain of command, technical knowledge, and fundamental knowledge of guns, missiles, and basic engineering. Comments regarding competency deficiencies in seamanship, ship handling, and watch standing were common.

If only IDSI surveys were used to judge this course of instruction, some could arrive at the erroneous conclusion that the program was not successful because Ensigns' initial performance aboard their first ships was lacking in some way. The IDSI surveys do not address the number of Ensigns whose performance the commanding officer's had been pleased or displeased with. It is possible that when answering the two survey questions discussed above, the respondents had only seen one or two junior officers that arrived aboard with the deficiencies listed. It is also possible, that the respondents were answering the surveys generally, and found most Ensigns lacking the knowledge or skills that were described in the answers.

Based on my experiences, there may be some merit to the notion that some Ensigns lacked in one or more aspects of knowledge or specific skills when they graduated from SWOS. However, even if true, the program cannot be described as a failure. It is possible, that utilizing a traditional classroom-lecture approach, coupled with minimal laboratory training prior to sending new Ensigns to their first ships, resulted in an inadequate internalization of knowledge, insufficient knowledge transfer, and subsequent deficits in either knowledge or a particular skill set that would lead to the comments found in the above mentioned survey. It is also possible, and argued by many that I have informally talked to, that the program was extremely successful, and only a handful of Ensigns ever reported aboard their first ship deficient in either knowledge or a particular set of skills.

Whatever the case, as a rule, once Ensigns checked aboard their first ship they received a lot of on the job training (OJT) and spent many hours studying for watchstation qualifications. The Ensigns were working with and studying the same information already taught to them in SWOS. It is likely the information

was recalled more easily since it had already been seen once before, processed, and stored in memory while at SWOS. However, there may have not been enough time to rehearse with the information that was taught in SWOS to successfully build semantic mappings. By being afforded the opportunity to study the information over a more prolonged period of time, semantic mappings were quickly constructed, and in general, the junior officers rapidly became knowledgeable and able to satisfactorily perform the tasks that were difficult when they first checked aboard.

4. Personal Experience

Students had opportunities to practice their budding skills in numerous laboratories. Students were able to practice ship-handling, communications, and damage control procedures in a relatively benign environment. Since student egos were the only things ever broken, these labs proved to be a positive training experience. However, time in these trainers was limited, and the best that could be expected from a novice student was basic familiarity with the concepts and principles being taught.

5. Conclusions About the Traditional SWOS Curriculum

The traditional SWOS division officer curriculum possessed defined learning objectives, a first-rate core curriculum, a feedback mechanism that effectively served its purpose, good assessment execution, and an established remediation process. It is possible that since large quantities of information was taught very rapidly, that some Ensigns could not process and rehearse with that information long enough to shift it into long-term memory and subsequently, into a semantic mapping. As a result, some of the Ensigns' knowledge within the realm of nautical instruction remained inert. Many times, out of necessity, Ensigns focused on and memorized enough facts to pass their next exam. These facts, however, tended to be easily forgotten, and so the knowledge remained "inert" (Nix and Spiro, 1990, p. 123).

If the new training initiative is going to receive good reviews from the fleet, an instructional methodology is needed that helps the students use multiple facts in constructive problem solving environments so that not only are facts

remembered, they become useful tools. Curriculums that utilize delivery methods that incorporate learning activities within the context that these activities normally occur, along with a presentation of the culture in which they occur, will best achieve the goal of knowledge transfer (Brown, Collins, and Duguid, 1989, p.33).

C. FIELD OBSERVATIONS

I am able to make several personal observations regarding this training initiative. These observations are in addition to survey data, but include information learned during post-survey discussions. Collecting survey data and making self-reporting field observations enables the viewing of information from multiple perspectives, and allows the verification of the specific field observations and survey data, to what extent each agrees with the other. Four general observations are made. First, implementation problems exist in every ship on the waterfront. Second, ship Training Officers are, with respect to the Division Officer At Sea training initiative, very frustrated. Third, the students are discouraged about the Division Officer At Sea training initiative. Forth, the training initiative's two stated goals are not well defined [1].

1. Implementation

Every ship I visited was currently experiencing implementation problems. One ship had not begun implementing the training program. Two ships had only one stand-alone computer that was used for this CBT. Several ships had installed the courseware on their local area network (LAN), but spent months troubleshooting bugs, and were still experiencing problems at the time of my visit. None of the training officers I talked to reported that their ship was not experiencing difficulties with implementation.

The manner in which this initiative has been locally implemented differs in two discernable ways than was discussed at the first kick-off meeting in May 2002. At this meeting, it was generally agreed that the Ensigns were not to be given division officer responsibilities until after they had qualified Officer of the

[1] 8 ships were visited. Post survey discussions with training officers also included the implementation problems of the other ships along the waterfront.

Deck (Underway). This qualification has historically taken between 12 and 18 months to complete depending upon the officer's abilities and ship's schedule. I observed that many of the junior officers enrolled in this program, most having been attached to their ships for less than three months, were assigned significant divisional responsibilities. Second, there was after a lot of debate in this kickoff meeting, a general consensus that the Ensigns would need computing resources supplied to them. The issue at the meeting was whether to directly supply each Ensign with a laptop computer or supply ships with computers that were to only be used in conjunction with this program. To date, neither has occurred and the Ensigns are falling behind schedule due to a lack of computer resources.

2. Training Officers

This process frustrates Training Officers. Training Officers believe that they were delivered a poor beta product and asked to implement it without sufficient instructions, training, or support from any of the other agencies involved with this program.

3. Students

Every Ensign I talked to appeared to want to succeed. Several, however, felt doubtful about their future success in this program because of the competition for resources and OJT time on the bridge. The students are competing for resources. Some ships have 8 to 10 Ensigns working their way through this training initiative. Ships do not have enough computers to study at. There are not enough technical manuals, publications, or instructions available to simultaneously support shipboard operations and student learning. Ensigns are being given division officer responsibilities, which occupy a tremendous amount of their time and significantly reduces the time available for quality learning.

OJT time is reduced for each Ensign. Ships are underway for limited periods of time each quarter. Ships are becoming overmanned with junior officers, and as a result, Ensigns are getting a smaller share of an already limited resource.

4. Training Initiative's Goals

The Division Officer at Sea Training Program Ship's Handbook defines the program goals. They are:

(1) To accelerate and enhance Surface Warfare Division Officer training so that the navy will produce better prepared leaders in less time (p. 1-3).

(2) To retain naval officers as career professionals (p. 1-3).

These two statements are vague and read more like slogans than quantifiable goals. For example, how will accelerated or enhanced training produce better leaders? Similarly, is it the increased retention of one or one hundred junior officers that will fulfill the second program goal? It appears there are no established rubrics, or standards, which have been provided to commanders to assist them in determining whether the program goals are being met at the shipboard, squadron, and fleet levels.

Optimally, educational objectives are derived from the program's goals. However, in this instance, the learning objectives are taken from the appropriate Personnel Qualifications Standards (PQS) books. A PQS book identifies the knowledge and skills that each officer must possess in order to stand the shipboard watch that the book was written for. Consequently, the program's goals have no bearing on this training initiative.

D. SURVEY DATA

Survey data reveals several strengths and weaknesses currently resident within the Surface Warfare School Command's Division Officer at Sea training initiative. Based upon survey data, program strengths include Strong Educational Objectives and a strong Core Curriculum. The Evaluation Framework surveys identified three significant weaknesses in this training initiative. The Instructional Evaluation category's Assessment function, the Program Operation function, and the Instructional Presentation function have significant weaknesses.

1. Program Strengths

Based upon survey responses and post survey interviews, the course's primary strengths are its educational objectives and core curriculum functions.

a. Educational Objectives

Despite having ill-defined program goals, the Educational Objectives are one of the strengths of this initiative. This is to be expected since designers of this CBT course simply transferred the course content that used to be taught in the classroom to CD-ROM. Because the traditionally taught curriculum had strong educational objectives and the information was relevant, current, and useful, it stands to reason that the CBT course would also possess similar characteristics. 93.8 percent of students agree that learning objectives are stated at the beginning of each lesson. Over half of the students confirm that the learning objectives are covered by instructional material. It can be concluded, therefore, that the courseware is teaching the information the Navy has deemed important since lessons are covering the learning objectives, which are derived from PQS.

Despite the Educational Objectives function strengths, the topics' learning objectives can be stated better. Nearly half of the students identified words or phrases in the learning objectives such as understand, list, explain, give an example of, describe, identify, recall, master, or differentiate. These words or phrases identify objectives in terms of what the teacher wants the student to do. They do not describe student performance in terms of what the student must do to satisfy an objective. When a student references the learning objectives as a checklist to verify that he or she knows all of the important material, it makes it easier on the student if these objectives are written from the student's perspective.

b. Core Curriculum

The Core Curriculum is this program's major strength. What is taught in this course is relevant, current, and useful. As previously mentioned, course content was transferred to a digital format. Information was neither to be added nor deleted during this transformation process. In its traditional format,

this curriculum was successfully taught to over 5,000 students from 1992 to 2002. It is the information in this curriculum that forms the foundation upon which an officer's professional knowledge is laid.

Over 80 percent of surveyed students believe the presentations are relevant to the associated topic and will help them perform their jobs better. Student comments regarding the instructional information is very positive. Multiple students stated that they believed the information is very pertinent, beneficial, and informative. Students also state they believe the information will positively reinforce what is learned through OJT.

75 percent of surveyed Training Officers felt the material is current and relevant to today's work environment. Additionally, the majority of the Training Officers believe the instructional material will help students perform their jobs better. In fact, one Training Officer reported that the drawings and diagrams included in this course are so good that they are now being used for ship-wide training.

2. Primary Weaknesses

Based upon survey responses and post survey interviews, this program's primary weaknesses are the Instructional Evaluation section's Assessment function, the instructional presentation function, and the program operation functions.

a. Assessment Function

The Assessment block is rated poorly because ships are experiencing tremendous difficulties with the courseware's testing module. Testing is a significant component to any training program. It is vital that these technical difficulties be investigated and corrected as soon as possible. Since I was unable to survey a student or supervisor that had successfully taken or given a module test, I am unable to adequately assess the function and rate it accordingly. Consequently, no further comments will be made concerning detailed analysis in this area.

b. Program Operation Function

The program operation function is rated low for numerous reasons. First, during follow-up interviews students and supervisors unanimously stated that the software is difficult to install and set up for use. Second, ships are experiencing compatibility issues with the software. Third, security policies may leave personal information at risk for compromise. Fourth, improvements can be made to the software's graphical user interface (GUI).

1. Installation Difficulties. The installation and set-up portions of this CBT software need to be automated. 100 percent of training officers believed that this CBT courseware is difficult to install and use. The majority of surveyed students believed the software was difficult to install or selected Not Applicable, since they did not install the software or had someone else install it for them. Installation is not intuitive, even to more experienced computer users. Some users, like myself, received three CD's containing the entire course. Others received up to six CD's. A few people were able to download the courseware from a website. Installation currently involves unzipping files into various folders and then searching through these folders to find a set of complicated instructions for adding students and using the software. Zipping and unzipping are terms that describe the compression and decompression of data. By zipping files, more files can be stored in a single location. However, zipping a file renders it unusable until it is unzipped.

All commercial software with multiple CD's includes an automated installation process. When a person inserts the first CD into the computer, they will have to answer a short series of questions and then the software automatically installs itself. The users have only to then remove and insert requested discs as the program is installed.

2. Software Compatibility. Ships are also reporting minor compatibility issues. The SWOS CBT courseware requires the use of Microsoft 2000 series of products to function properly. Many of the ships I visited did not have the required LAN infrastructure to support the courseware's Microsoft 2000 series requirement. Due to increasingly tight budget constraints and licensing

issues, it seems doubtful that these ships will start utilizing the required Microsoft products in the foreseeable future.

3. Security Policies. Training Officers report that all student data is stored on a computer, or computers, that have direct access to the Internet. Even if data is stored on a computer that resides behind a firewall, it is well known that the data is not secure if that computer has direct access to the Internet. There are two possible solutions for quickly and inexpensively improving security and lowering the risk of compromising sensitive information. First, move the data to a computer that cannot be connected to the Internet. This is known as air-gapping. Transmit and receive the data via computers that are connected to the Internet, but move it by floppy diskette to an air-gapped machine for storage. This is what most, if not all, major banks have resorted to in order to decrease the risk of compromise. The second option, and the one I personally favor, is to encrypt all student data and leave it encrypted while it is stored on the computer's hard drive. There are very strong encryption algorithms available that cannot easily be broken using even advanced techniques that would serve this purpose very well.

4. Graphical User Interface. During post survey interviews, the students made two recommendations for improving the courseware's GUI. Although mixed results appear on the survey (40 percent said they could not track lesson progress), students desire a graphical representation of their progress through each lesson. This can be accomplished with a graphical dot on a sliding bar across the top of the computer screen. It will help the students to judge how far they have come in each lesson and my serve as a positive motivator to continue through the end of each lesson. The second recommendation is to link all the related lessons in such a way as to make them accessible from the end of all of the lessons that are related. Many times, a group of three or four topics will be completed by the students and they have to exit out of the GUI to select another related topic in the same module. The students stated this was a source of irritation that served to demotivate them over time.

c. Instructional Presentation

The instructional presentation function contains eight elements. Four of these elements, Text, Questioning, Lesson Sequencing, and Color, received favorable marks by the majority of those surveyed. Unfortunately, three of the four remaining elements, Interactivity, Environment, and Instructional Quality, received poor marks by those taking the survey.

1. Interactivity. A highly interactive lesson is one that will engage the students, raise their curiosity and interest, and positively motivate them to learn. It does this by forcing students to act upon new information multiple times, significantly increasing the probability that the information becomes resident in long-term memory and semantic maps. 76 percent of students disagreed with a survey item asking if lessons kept their attention. Additionally, the same percentage of students disagreed with a survey item asking if the lessons were entertaining. 11 of the 17 students reported that they were frequently bored while using the instructional software. The students complain that there is too much reading that has to be done on screen.

Students who are bored and uninterested are more likely than motivated students to page through lessons as fast as they can and devise other methods for learning the material, or worse, figure out how to survive without learning the material. Because of this, it is important that the presentations be improved, making them more interactive and entertaining to the students. A previous chapter details the benefits of multi-modal presentations. The increased use of audio narration, movies, video clips, and more multi-layered interactive pictures in conjunction with the textual content is a good place to start improving the lessons.

2. Environment. This element receives a low grade for two reasons. Students are having a difficult time finding instructional resources that are available long enough to complete most lessons. Additionally, students are often interrupted or called away in the middle of lessons.

Every student I surveyed told me that resources were scarce. 70 percent of surveyed students said that they did not have immediate

access to instructional resources such as computers, software, books, instructions, or manuals. As previously mentioned, computers are in high demand and short supply. Ship's business takes priority over Ensign training time. According to students, ships have not received any more manuals, despite now being burdened with training newly commissioned officers. While underway, manuals that are needed to study are also needed by the watch standers in performance of their duties. Consequently, students do not get to study many of the manuals while a ship is underway. In the traditional classroom curriculum, each student was provided a safe containing a copy of every manual that was needed to learn from.

Only two of surveyed students have been able to start and complete lessons without interruption. Over half of the students report that they are frequently called away in the middle of lessons. It is difficult for students to take in new information, move that information through their STSS into working memory, and act on it long enough to store it in long-term memory, if they are consistently being interrupted or called away in the middle of their studies.

65 percent of students and 75 percent of supervisors feel that a different location can or should be used for learning with this CBT software. The students and their training officers contend, and I agree, that there should be a centralized location, or learning resource room, on the waterfront where they can go to study while their ship is in its homeport. This would allow students learn in a quiet, distraction free environment while taking the CBT lessons. When finished, the students can go back to their ships and receive reinforcing training via practicums or walk-throughs.

3. Instructional Quality/Effectiveness. Comparing the strengths and weaknesses within the Pedagogical Evaluation and Instructional Evaluation sections determines the instructional Quality and effectiveness of the CBT initiative. The following paragraphs summarize the previously discussed key points that are relevant to this function's rating.

The strength of this initiative rests squarely in its core curriculum function. The information that is being taught to the students is

relevant, current, and useful. However, this may not be enough to ensure the success of this program. Initial difficulties that Ensigns are experiencing are not making a favorable impression of the warfare community on them. These Ensigns' difficulties and initial impressions of this training initiative may ultimately lead to decreased retention within the community.

The lessons lack needed elements of excitement and interactivity. The Ensigns report that they are often bored. The students have many duties, often sacrificing needed sleep to take a CBT lesson, and are frequently disappointed by the way the information is delivered. Additionally, students are having a difficult time finding available computers to use, and when they are able to use one, are frequently interrupted or called away.

Students must often rely on department heads, peers, and watch standers for their instruction. These people are all very busy, and do not necessarily have the time required to properly teach a concept or skill. Additionally, these sailors may not have any instructor training or have the requisite ability to effectively teach or train others. For example, the junior Quartermaster standing Quartermaster of the Watch on the ship's bridge, may not have the time or the ability to thoroughly explain and answer questions about set, drift, dead reckoning, and aspects of celestial navigation to an Ensign the comes to the bridge for training.

The students also One of the most telling data points is that all of the Training Officers believe that the program does not reduce the time it takes to learn Surface Warfare Officer skills. If learning time is not reduced how can the first program goal ever be achieved? As a result of the above discussion, Instructional Quality and Effectiveness is rated as very low.

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V. RECOMMENDATIONS

A. FURTHER RESEARCH

IDSI delivered this CBT initiative to the Navy early this year. The majority of new accessions into the Surface Warfare community are May and June graduates. Consequently, most new students are just starting their course of instruction with this CBT software. To date, nobody has fulfilled all of the requirements of this program and earned their Surface Warfare Pin. It is recommended that this program be tracked and compared to the traditional classroom course of instruction in two broad areas.

1. Knowledge Value Added Analysis

First, conduct a Knowledge Value Added analysis on the two curriculums to verify that this CBT initiative is generating an appropriate return on investment. If not, this process will allow evaluators to identify which processes in the program need to be modified or eliminated in order to then generate appropriate returns on the surface warfare community's investment. Since this program is in its infancy, and has no graduates, there is currently not enough available data to support an analysis of this kind at present.

2. Track and Compare Student Progress with Historical Data

Second, track the students' progress from the time they arrive at their first ships to the time they earn their CIC Watch Officer and Officer of the Deck (underway) qualifications and also their warfare pins. Compare these results to the historical qualification data with students that graduated from SWOS in Newport, Rhode Island.

B. NON-SOFTWARE RELATED RECOMMENDATIONS

Following a review of personal observations and an analysis of survey and interview data, three recommendations are provided. First, it is recommended that the primary surface warfare training activity on each coast be directed to conduct thorough evaluations of ships' implementation and execution progress as long as Ensigns are trained via this program. For example, it is recommended that the Atlantic Training Group (ATG) be designated as the East Coast's training

command responsible for evaluating ships' implementation and execution of this CBT initiative. Second, It is recommended that a waterfront study space/learning resource center (LRC) be established in every fleet concentration area so that a distraction free, off-ship learning environment is created for all students in this program. Third, it is recommended that increased resources, including computers, Navy instructions, publications, and technical manuals be provided to all ships for the exclusive use of junior officers enrolled in this program.

1. Include Training Commands

Involving the primary training commands on each coast accomplishes several things vital to the success of this program. First, it places much needed help and assistance near the waterfront on both coasts. The training officers complained that they have been unsuccessful getting the help they need to fully implement this program. Personnel at the training command would be trained how to properly install and run the software, and would render assistance to nearby ships when it is needed. A Lieutenant Commander, with the assistance of two or three Lieutenants, and a handful of skilled enlisted specialists at each of these training commands would be able to perform the requisite tasks associated with this CBT initiative.

Second, by empowering the training commands to conduct annual or semi-annual program evaluations, it ensures that all Ensigns receive the necessary and quality instruction that is needed to transform them into the outstanding professional mariners that the Navy is known for.

Third, it allows waterfront seminars to be conducted on a routine basis with little expense to the government. These seminars would allow supervisors and students to act collaboratively to solve problems, increase awareness, discuss cross-decking opportunities, and improve the quality of junior officers' training regimens.

2. Create Waterfront Learning Resource Centers

The creation of a waterfront learning resource center is very beneficial for students in this program. At present, students are finding it very difficult to complete lessons without interruption. A quiet, distraction free environment will

improve retention, and subsequently, learning transfer, among the students. Additionally, instructional resources would be in a centralized, easily maintainable location. In times of fiscal constraint, a twenty-computer LAN that is located in an LRC is less costly than two or three computers placed on every ship, and is much more economical than buying a laptop for every student. Finally, a LRC allows students to work together and learn collaboratively, which research has shown will lead to improved retention and performance.

3. Increase Instructional Resources

It is important that students have nearly ubiquitous access to computers while they are enrolled in a mandatory self-paced Computer-based training program. There are not enough computers, publications, and other instructional material on-hand to ensure that the students receive the same quality of training as was received when it was conducted in Newport, Rhode Island. Not supplying the students with the resources necessary for successful completion of the program is akin to shooting yourself in the foot. Since these officers are the future of this warfare community, it is important that the Navy supply them with the necessary tools to complete this course of study.

C. SWOS DOC CBT SOFTWARE RELATED RECOMMENDATIONS

Three recommendations related to the software are provided. First, and most important, it is recommended that the courseware presentations be modified and made more interactive and exciting. Second, it is recommended that the software be modified to encrypt all data prior to saving it on either a portable media or fixed hard drive.

1. Improve Instructional Presentations

It is important that the lesson presentations be improved. Students unanimously reported that lessons are, despite containing useful information, very boring. More interactive activities need to be included in the lessons. These include, but are not limited to numerous questioning techniques, point, click and drag activities, and video segments that offer students a choice at their end. Each choice starts another video segment, so the student can see and hear the consequences of the choices made. To make the lessons less dull, more

video, animation, interactive pictures, and audio narration should be incorporated. Many successful CBT training packages include audio narration. Additionally, audio narration makes presentations bimodal, and as mentioned in a previous chapter, improves student retention. By improving the lessons' level of interaction and making them exciting, student curiosity, interest, and motivation will be improved. As a result, more information will be acted upon, memory function will increase, and more transfer will occur. The end result will be better-trained officers that are able to apply more of what they learned via the CBT software to very complex real-life situations.

2. Add an Encryption Standard

By adding an automated encryption scheme to the CBT software package, the Navy will significantly increase the safety of personal and performance information stored on its computers. Students' personal and performance data will be collected, transmitted, and warehoused multiple times throughout the duration of this training initiative. By keeping the data encrypted, and decrypting it only when reading or performing maintenance on the files, hackers and other individuals with malicious intent will be unable to decipher, read, alter, or use any data that may be intercepted or otherwise compromised.

D. CONCLUSION

By implementing the recommendations that are presented here, the Navy will transform this CBT training initiative from a lackluster performer into a shining example of what an organization can accomplish through the use of Computer-based training that is reinforced through real world experience while on the job. Implementation of the following recommendations will achieve the following:

(1) Student interest and motivation will improve. Learning transfer will improve, and consequently, performance will improve.

(2) The programs objectives will be met because

(a) Qualification times for all watch stations will be reduced. As a result, the program's first stated goal of better-prepared Surface Warfare Officers in less time will become a reality.

(b) An increase in qualified officers amounts to more watch sections while underway. As a result of the increase in watch sections, each officer has more time off to pursue other qualifications and interests. As a consequence, morale among the junior officers will increase, leading to better retention. This satisfies the program's second goal of improving retention rates among in its officer corps.

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APPENDIX A. STUDENT AND SUPERVISOR SURVEYS

A. STUDENT SURVEY

STUDENT'S SURVEY OF INSTRUCTION

Please mark your choices by placing a check mark in the appropriate box for each of the following items. Your specific answers will remain completely anonymous, but your views, in combination with those of others, are extremely important.

SECTION 1: YOUR BACKGROUND AND USE OF COMPUTERS

1. What is your age?

Under 25.....• 26 to 30.....• 31 to 35.....• 36 to 40.....•
41 or older.....•

2. What is your Gender?

Male.....• Female.....•

3. What is your primary position with respect to this training initiative?

Student.....• Instructor.....• Administrator / Supervisor.....•

4. How would you rate your computer skills?

Novice or Beginner.....• Intermediate.....•
Advanced or Expert.....•

SECTION II: INSTRUCTIONAL QUALITY ASSESSMENT

Please circle the number that best represents your view regarding the content of the SWOS DIVISION OFFICER COURSEWARE .

If a particular item is Not Applicable, please circle NA.
If you Strongly agree with the statement, please circle the Five (5).
If you agree with a statement, please circle Four (4).
If you neither agree or disagree with an item, please circle Three (3).
If you Disagree with a statement, please circle Two (2).
If you Strongly Disagree with a statement, please Circle One (1).

1. I understood the purpose of the course NA....1....2....3....4....5
2. The learning objectives were clearly stated NA....1....2....3....4....5
3. The information that was presented was relevant to the topic NA....1....2....3....4....5

4. Learning objectives were listed at the beginning of every lesson NA....1....2....3....4....5

5. All of the learning objectives were covered by the instructional material NA....1....2....3....4....5

6. Learning objectives include key words or phrases such as create, install, set-up, start, repair, diagnose, troubleshoot, organize, or write NA....1....2....3....4....5

7. Learning objectives include key words or phrases such as understand, list, explain, give an example of, describe, identify, recall, master, or differentiate NA....1....2....3....4....5

8. All of the information that was required to satisfy stated performance criteria was provided in the lessons NA....1....2....3....4....5

9. The information I learned will help me perform better NA....1....2....3....4....5

10. I found the material in this course very useful NA....1....2....3....4....5

11. Test questions were based upon the learning objectives NA....1....2....3....4....5

12. Test questions only covered items I had been taught NA....1....2....3....4....5

13. Directions for each test were clear NA....1....2....3....4....5

14. I understood the performance standard for each test or quiz NA....1....2....3....4....5

15. I understood the performance standard for each graded activity NA....1....2....3....4....5

16. Tests were fairly and properly proctored / administered NA....1....2....3....4....5

17. I received timely feedback about my test scores NA....1....2....3....4....5

18. The feedback I received regarding tests was valuable NA....1....2....3....4....5

19. The feedback I received regarding my test scores will help me improve my performance NA....1....2....3....4....5

20. Graded activities were fairly and properly administered NA....1....2....3....4....5

21. I received timely feedback regarding my graded activities NA....1....2....3....4....5

22. The feedback I received regarding my graded activities was valuable NA....1....2....3....4....5

23. The feedback I received regarding graded activities will help me improve my performance NA....1....2....3....4....5

24. The software was easy to install NA....1....2....3....4....5

25. The software was easy to use NA....1....2....3....4....5

26. The software menu was easy to find NA....1....2....3....4....5

27. The software was easy to navigate	NA....1....2....3....4....5
28. Directions were easy to find	NA....1....2....3....4....5
29. Directions were easy to follow	NA....1....2....3....4....5
30. On-screen options were easily understood	NA....1....2....3....4....5
31. The software had an integrated search function	NA....1....2....3....4....5
32. I always knew where to look for on-screen help	NA....1....2....3....4....5
33. Human help was always available	NA....1....2....3....4....5
34. I was always able to page forward	NA....1....2....3....4....5
35. I was always able to page back	NA....1....2....3....4....5
36. I was able to bookmark my location and come back later	NA....1....2....3....4....5
37. I was able to track my progress though each lesson	NA....1....2....3....4....5
38. I was able to track my progress through the training program	NA....1....2....3....4....5
39. I was able to easily generate practice tests	NA....1....2....3....4....5
40. Each lesson kept my attention	NA....1....2....3....4....5
41. I thought the lessons were entertaining	NA....1....2....3....4....5
42. The multimedia used in each lesson was relevant	NA....1....2....3....4....5
43. Lessons incorporated audio narration	NA....1....2....3....4....5
44. High-resolution graphics / pictures were incorporated into each lesson	NA....1....2....3....4....5
45. The use of relevant video, animation, and pictures were incorporated into each lesson	NA....1....2....3....4....5
46. The use of video, animation, and pictures in each lesson kept my interest	NA....1....2....3....4....5
47. There were too many videos, animations or pictures in each lesson	NA....1....2....3....4....5
48. The information in each lesson was worthwhile	NA....1....2....3....4....5
49. The courseware taught me useful information	NA....1....2....3....4....5
50. After using the courseware, I understand the material better	NA....1....2....3....4....5
51. I was frequently bored while using the instructional software	NA....1....2....3....4....5
52. The use of color enhanced the instructional presentations	NA....1....2....3....4....5
53. Contrasts in the use of color made text easier to read	NA....1....2....3....4....5

54. I always had access to a quiet, comfortable, distraction free learning environment NA....1....2....3....4....5

55. I was frequently interrupted or called away while using the courseware NA....1....2....3....4....5

56. I was able to start and complete a lesson without interruption NA....1....2....3....4....5

57. I always had immediate access to instructional resources such as computers, software, books, instructions, or manuals NA....1....2....3....4....5

58. A different location can or should be used for learning via this CBT software NA....1....2....3....4....5

59. I was able to easily read textual information NA....1....2....3....4....5

60. I had to scroll down through the text that was on the screen NA....1....2....3....4....5

61. The questions I was asked focused on information I had already been taught NA....1....2....3....4....5

62. The questions I was asked focused on information that I was about to learn NA....1....2....3....4....5

63. The questions I was asked were related to the topic's learning objectives NA....1....2....3....4....5

SECTION III: SHORT ANSWER

Please legibly print your answers to the following questions. There are no correct or incorrect responses. However, specific and detailed answers are appreciated. If a question is not applicable to your situation, either leave the answer blank or use N/A. Your specific answers will remain completely anonymous.

1. Have you ever failed to meet the required standards for an activity or a test? If yes, why do you believe that you failed to meet the required standards?

_____
_____
_____

2. If you answered yes to the above question, did you receive remediation? If yes, why was the remediation you received either effective or ineffective?

_____
_____
_____
_____
_____

3. What are the best parts of this course and why?

4. What are the worst parts of this course and why?

5. What should be done to improve this course of instruction?

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY.

B. SUPERVISOR SURVEY

SUPERVISOR'S SURVEY OF INSTRUCTION

Please mark your choices by placing a checkmark in the appropriate box for each of the following items. Your specific answers will remain completely anonymous, but your views, in combination with those of others, are extremely important.

SECTION 1: YOUR BACKGROUND AND USE OF COMPUTERS

1. What is your age?

Under 25.....• 26 to 30. .....• 31 to 35. .....• 36 to 40. .....•

41 to 45 .....• 45 to 50. .....• Over 50.....•

2. What is your Gender?

Male.....• Female.....•

3. What is your primary position with respect to this training initiative?

Student.....• Instructor.....• Administrator / Supervisor.....•

4. How would you rate your computer skills?

Novice or Beginner.....• Intermediate.....•

Advanced or Expert.....•

SECTION II: INSTRUCTIONAL QUALITY ASSESSMENT

Please circle the number that best represents your view regarding the SWOS DIVISION OFFICER COURSEWARE.

If a particular item is Not Applicable, please circle NA.
If you Strongly agree with the statement, please circle the Five (5).
If you agree with a statement, please circle Four (4).
If you neither agree or disagree with an item, please circle Three (3).
If you Disagree with a statement, please circle Two (2).
If you Strongly Disagree with a statement, please Circle One (1).

1. The SWOSCOLCOM Division Officer At Sea Training Initiative's goals are well defined NA....1....2....3....4....5
2. I know where the SWOSCOLCOM Division Officer At Sea Training Initiative's goals are defined NA....1....2....3....4....5

3. The Training Initiative's goals do not conflict with other organizational goals NA....1....2....3....4....5

4. This course reduces the students' OJT requirements NA....1....2....3....4....5

5. This course reduces the time it takes students to learn Surface Warfare Officer job skills NA....1....2....3....4....5

6. Each topic has associated learning objectives NA....1....2....3....4....5

7. Learning objectives are presented at the beginning of every lesson NA....1....2....3....4....5

8. Learning objectives include key words or phrases such as create, install, set-up, start, repair, diagnose, troubleshoot, organize, or write NA....1....2....3....4....5

9. Learning objectives include key words or phrases such as understand, list, explain, give an example of, describe, identify, recall, master, or differentiate NA....1....2....3....4....5

10. The learning objectives support the organizational training initiative's goals NA....1....2....3....4....5

11. Test questions are derived from the learning objectives NA....1....2....3....4....5

12. Student performance standards are derived from the learning objectives NA....1....2....3....4....5

13. All student performance standards are published NA....1....2....3....4....5

14. Students understand the grading criteria for each and every test and graded activity NA....1....2....3....4....5

15. Information taught to the students is relevant to the topic NA....1....2....3....4....5

16. The instructional presentations cover all the learning objectives NA....1....2....3....4....5

17. Instructional material is current and up to date NA....1....2....3....4....5

18. Instructional material will help the students perform their jobs better NA....1....2....3....4....5

19. Directions for each test and graded activity are clear NA....1....2....3....4....5

20. Tests and graded activities are fair NA....1....2....3....4....5

21. Remediation is available for students NA....1....2....3....4....5

22. Remediation for failing to meet a standard is effective NA....1....2....3....4....5

23. Each test proctor or activity participant other than the student is identified in advance NA....1....2....3....4....5

24. Each test proctor or activity participant other than the student is trained and qualified for the part of the test or activity they are participating in NA....1....2....3....4....5

25. All tests are given and graded by the computer NA....1....2....3....4....5

26. For all test items not graded by a computer, the criteria for a fully correct answer is known by the grader NA....1....2....3....4....5

27. For all test items not graded by a computer, the performance criteria for fully correct answers are established NA....1....2....3....4....5

28. For all test items not graded by a computer, the criteria for a fully correct answer is used to grade a particular test item NA....1....2....3....4....5

29. For all test items not graded by a computer, the same person that writes the test also grades it NA....1....2....3....4....5

30. For all performance based activities, the criteria for correctly performed actions is known by the grader NA....1....2....3....4....5

31. For all performance based activities, the criteria for correctly performed actions is always strictly used by the grader NA....1....2....3....4....5

32. The collection of student test and activity performance data enhances organizational performance NA....1....2....3....4....5

33. Students receive timely feedback regarding their performance NA....1....2....3....4....5

34. Feedback to students is relevant and useful to them NA....1....2....3....4....5

35. Feedback to students either praises them or identifies a weakness and reveals how to correct that deficiency NA....1....2....3....4....5

36. The software / courseware is easy to install NA....1....2....3....4....5

37. The software / courseware is easy to use NA....1....2....3....4....5

38. Student progress is easily tracked via the courseware NA....1....2....3....4....5

39. The courseware adequately protects personal information NA....1....2....3....4....5

40. Files where personal or performance information is stored are password protected NA....1....2....3....4....5

41. Personal and performance information is encrypted during transfers between locations NA....1....2....3....4....5

42. Personal and performance data is stored, updated, and maintained on a computer that has direct access to the Internet NA....1....2....3....4....5

43. Personal and performance data is only downloaded on a computer that has direct access to the Internet, but stored on a computer that has zero Internet access (air gapped) NA....1....2....3....4....5

44. Students are provided a quiet, distraction free environment NA....1....2....3....4....5

45. Students are not interrupted or called away while using the courseware to learn NA....1....2....3....4....5

46. A different location can or should be used for learning via this computer-based training software NA....1....2....3....4....5

47. This computer-based training program's administrators and supervisors are all adequately trained NA....1....2....3....4....5

48. Evaluation standards for assessing this computer-based training initiative have been established NA....1....2....3....4....5

49. Evaluation standards for assessing this computer-based training initiative have been promulgated NA....1....2....3....4....5

50. The standards for this computer-based training initiative are being met or exceeded NA....1....2....3....4....5

51. Formal standards are established for the presentation of this training initiative's instructional material by means other than the computer (watch standers) NA....1....2....3....4....5

52. Instructional presentations of this training initiative's material by means other than a computer is closely monitored NA....1....2....3....4....5

SECTION III: SHORT ANSWER

Please legibly print your answers to the following questions. There are no correct or incorrect responses. However, specific and detailed answers are appreciated. If a question is not applicable to your situation, either leave the answer blank or use N/A. Your specific answers will remain completely anonymous.

1. If the SWOSCOLCOM Division Officer At Sea Training Initiative's goals can be better defined, how would you change them to make them better?

_____
_____
_____
_____
_____
_____
_____
_____
_____

2. How are the students' performance standards for graded activities established? Are these standards uniform throughout the fleet?

3. What is done with the collected student test and activity performance data?

4. Does the collection of student test and activity performance data enhance or benefit organizational performance? If so, how?

5. Does the organization require periodic evaluations of this training initiative? If so, what aspects of this Computer-based training initiative are to be evaluated?

6. What is the procedure for reporting weaknesses or deficiencies that are discovered in the SWOSCOLCOM Division Officer At Sea Training Initiative?

7. If a weakness or deficiency is discovered in the SWOSCOLCOM Division Officer At Sea Training Initiative, what is the maximum time that is allotted to correct it?

8. Are standards established for the presentation of instructional material via CBT? If yes, please explain why or how those standards have or have not been met.

9. What is / are the major strengths of this CBT initiative?

10. What is / are the major weaknesses of this CBT initiative?

11. What should be done to improve this course of instruction?

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APPENDIX B. COMPLETE SURVEY DATA

A. RESPONSES TO STUDENT SURVEY, PART II

NUMBER	QUESTION	N/A	1	2	3	4	5
1	I understood the purpose of this course	0	0	1	2	10	4
2	The learning objectives were clearly stated	0	0	2	3	9	3
3	The information that was presented was relevant to the topic	1	0	0	2	11	3
4	Learning objectives were listed at the beginning of every lesson	1	0	0	0	10	5
5	All of the learning objectives were covered by the instructional material	1	0	1	5	6	3
6	Learning objectives include key words or phrases such as create, install, set-up, start, repair, diagnose, troubleshoot, organize or write	2	3	3	6	2	0
7	Learning objectives include key words or phrases such as understand, list, explain, give an example of, describe, identify, recall, master, or differentiate	2	1	1	5	5	2
8	All of the information that was required to satisfy stated performance criteria was provided in the lessons	1	3	3	2	7	0
9	The information I learned will help me perform my job better	1	0	2	1	12	0
10	I found the material in this course very useful	1	0	1	5	8	1
11	Test questions were based upon the learning objectives	5	1	0	3	6	1
12	Test questions only covered items I had been taught	5	1	2	2	4	2
13	Directions for each test were clear	5	0	0	3	6	2
14	I understood the performance standard for each test or quiz	4	0	1	2	6	3
15	I understood the performance standard for each graded activity	4	0	1	2	7	2
16	Tests were fairly and properly proctored / administered	10	0	0	1	4	1
17	I received timely feedback about my test scores	11	0	1	2	2	0
18	The feedback I received regarding tests was valuable	11	0	0	2	3	0
19	The feedback I received regarding my test scores will help me improve my performance	11	0	0	1	4	0
20	Graded activities were fairly and properly administered	10	0	0	3	3	0
21	I received timely feedback regarding my graded activities	11	0	0	2	3	0
22	The feedback I received regarding my graded activities was valuable	11	0	0	2	3	0
23	The feedback I received regarding my graded activities will help me improved my performance	11	0	0	3	2	0

24	The software was easy to install	6	6	1	1	1	1
25	The software was easy to use	0	2	7	1	2	4
26	The software menu was easy to find	1	3	2	5	2	3
27	The software was easy to navigate	1	2	3	3	4	4
28	Directions were easy to find	0	3	4	3	6	1
29	Directions were easy to follow	1	2	2	3	6	3
30	On-screen options were easily understood	1	1	2	1	9	3
31	The software had an integrated search function	4	6	3	2	2	0
32	I always knew where to look for on-screen help	3	2	4	4	4	0
33	Human help was always available	1	4	5	4	3	
34	I was always able to page forward	1	1	4	1	8	2
35	I was always able to page back	1	1	4	1	8	2
36	I was able to bookmark my location and come back later	3	2	6	2	3	1
37	I was able to track my progress through each lesson	2	2	6	2	5	0
38	I was able to track my progress through the training program	3	3	4	2	5	0
39	I was able to easily generate practice tests	3	3	2	3	5	1
40	Each lesson kept my attention	1	5	8	1	2	0
41	I thought the lessons were entertaining	1	9	4	1	2	0
42	The multimedia used in each lesson was relevant	2	0	3	4	8	0
43	Lessons incorporated audio narration	3	9	4	0	1	0
44	High-resolution graphics / pictures were incorporated into each lesson	2	2	2	1	9	1
45	The use of relevant video, animation, and pictures were incorporated into each lesson	1	0	3	2	10	1
46	The use of video, animation, and pictures in each lesson kept my interest	1	1	6	2	5	2
47	There were too many videos, animations, or pictures in each lesson	3	7	3	4	0	0
48	The information in each lesson was worthwhile	1	0	2	2	2	0
49	The courseware taught me useful information	1	0	2	1	2	1
50	After using the courseware, I understand the material better	1	0	2	2	1	1
51	I was frequently bored while using the instructional software	1	1	1	3	3	8
52	The use of color enhance the instructional presentations	2	0	0	2	11	2
53	Contrasts in the use of color made text easier to read	1	0	1	1	3	1
54	I always had access to a quiet, comfortable, distraction free learning environment	0	9	1	2	2	3
55	I was frequently interrupted or called away while using the courseware	1	3	2	2	5	4
56	I was able to start and complete a lesson without interruption	1	6	4	4	1	1

57	I always had immediate access to instructional resources such as computers, software, books, instructions or manuals	0	8	4	2	2	1
58	A different location can or should be used for learning via this CBT software	1	1	2	2	6	5
59	I was able to easily read textual information	2	1	0	4	9	1
60	I had to scroll down through the text that was on the screen	4	3	5	3	2	0
61	The questions I was asked focused on information I had already been taught	1	1	7	4	4	0
62	The questions I was asked focused on information that I was about to learn	1	0	6	3	7	0
63	The questions I was asked were related to the topic's learning objectives	1	1	0	1	3	1

Table 2. Responses to Student Survey, Part II

B. RESPONSES TO SUPERVISOR SURVEY, PART II

NUMBER	QUESTION	N/A	1	2	3	4	5
1	The SWOSCOLCOM Division Officer At Sea Training Initiative's goals are well defined	0	0	0	1	3	0
2	I know where the SWOSCOLCOM Division Officer At Sea Training Initiative's goals are defined	0	0	0	1	3	0
3	The Training Initiative's goals do not conflict with other organizational goals	0	0	1	1	2	0
4	This course reduces the student's OJT requirements	0	3	1	0	0	0
5	This course reduces the time it takes students to learn Surface Warfare Officer job skills	0	2	2	0	0	0
6	Each topic has associated learning objectives	0	1	2	0	1	0
7	Learning objectives are presented at the beginning of every lesson	0	0	0	0	4	0
8	Learning objectives include key words or phrases such as create, install, set-up, start, repair, diagnose, troubleshoot, organize or write	0	0	0	0	4	0
9	Learning objectives include key words or phrases such as understand, list, explain, give an example of, describe, identify, recall, master, or differentiate	0	0	0	1	3	0
10	The learning objectives support the organizational training initiative's goals	0	0	1	2	1	0
11	Test questions are derived from the learning objectives	0	0	0	0	3	1
12	Students performance standards are derived from the learning objectives	0	0	2	1	1	0
13	All student performance standards are published	0	0	3	1	0	0
14	Students understand the grading criteria for each and every test and graded activity	1	0	2	0	1	0
15	Information taught to the students is relevant to the topic	0	0	1	0	2	1

16	The instructional presentations cover all the learning objectives	0	0	0	1	3	0
17	Instructional material is current and up to date	0	0	0	1	3	0
18	Instructional material will help the students perform their jobs better	0	0	1	1	1	1
19	Directions for each test and graded activity are clear	1	0	1	0	2	0
20	Tests and graded activities are fair	1	0	0	1	2	0
21	Remediation is available for students	0	0	0	2	2	0
22	Remediation for failing to meet a standard is effective	0	0	0	3	1	0
23	Each test proctor or activity participant other than the student is identified in advance	0	0	2	1	1	0
24	Each test proctor or activity participant other than the student is trained and qualified for the part of the test or activity they are participating in	0	0	1	1	1	1
25	All tests are given and graded by the computer	2	0	0	2	0	0
26	For all test items not graded by a computer, the criteria for a fully correct answer is known by the grader	2	0	0	1	1	0
27	For all test items not graded by a computer, the performance criteria for fully correct answers are established	2	0	0	3	1	0
28	For all test items not graded by a computer, the criteria for a fully correct answer is used to grade a particular test item	2	0	1	1	0	0
29	For all test items not graded by a computer, the same person that writes the test also grades it	2	0	0	2	0	0
30	For all performance based activities, the criteria for correctly performed actions is known by the grader	3	0	0	1	0	0
31	For all performance based activities, the criteria for correctly performed actions is always strictly used by the grader	2	0	1	1	0	0
32	The collection of student test and activity performance data enhances organizational performance	2	0	2	0	0	0
33	Students receive timely feedback regarding their performance	2	0	0	1	1	0
34	Feedback students receive is relevant and useful to them	2	0	0	0	2	0
35	Feedback to students either praises them or identifies a weakness and reveals how to correct the deficiency	2	0	1	1	0	0
36	The software / courseware is easy to install	0	3	1	0	0	0
37	The software / courseware is easy to use	0	2	2	0	0	0
38	Student progress is easily tracked via the courseware	0	3	0	1	0	0
39	The courseware adequately protects personal information	0	0	0	2	2	0
40	Files where personal or performance information is stored are password protected	0	0	1	1	2	0

41	Personal and performance information is encrypted during transfers between locations	0	0	0	4	0	0
42	Personal and performance data is stored, updated, and maintained on a computer that has direct access to the Internet	0	0	0	1	3	0
43	Personal and performance data is only downloaded on a computer that has direct access to the Internet, but is stored on a computer that has zero Internet access (air gapped)	0	0	4	0	0	0
44	Students are provided a quiet, distraction fee environment	0	0	2	0	1	1
45	Students are not interrupted or called away while using the courseware to learn	0	1	2	0	1	0
46	A different location can or should be used for learning via this computer-based training software	0	0	1	0	3	0
47	This computer-based training program's administrators and supervisors are all adequately trained	0	3	1	0	0	0
48	Evaluation standards for assessing this computer-based training initiative have been established	0	0	3	0	1	0
49	Evaluation standards for assessing this computer-based training initiative have been promulgated	0	0	3	1	0	0
50	The standards for this computer-based training initiative are being met or exceeded	1	1	2	0	0	0
51	Formal standards are established for the presentation of this training initiative's instructional material by means other than the computer (watch standers)	0	0	2	0	2	0
52	Instructional presentations of this training initiative's material by means other than a computer is closely monitored	0	0	2	0	2	0

Table 3. Responses to Supervisor Survey, Part II

C. RESPONSES TO STUDENT SURVEYS, PART III

Question 1. Have you ever failed to meet the required standards for an activity or test? If yes, why do you believe that you failed to meet the required standards?

(1) Yes, sometimes test / quiz questions asked for material that was not sufficiently covered during the lesson.

(2) Yes, DC was especially difficult. The test (practical test) asked many questions that weren't in the training.

(3) Only on the practical assessments. I believe the cause was too much information to go through before being tested. It was hard to retain the info(4) Yes, the required standards were never stated.

(5) Yes for an exercise, no for test.

(6) Yes, the exams are too detailed with useless information.

(7) I have not attempted a test yet.

(8) I have passed all tests taken.

Question 2. If you answered yes to the above question, did you receive remediation? If yes, why was the remediation you received either effective or ineffective?

(1) No, there is no sort of remediation system on this ship.

(2) No…no support resources were available. Our DC workbooks, for example, leaves a lot to be desired.

(3) Never received remediation because the administration did not know the standards, therefore it was ineffective.

(4) Received immediate remediation for the exercise I failed to meet requirements for. Very effective.

Question 3. What should be done to improve this course of instruction?

(1) Make a conscious consistent effort to upgrade the software.

(2) More computers

(3) Give us a training manual. Give us our own copy of the software if you don't give us a training manual or give us a computer to install it on.

(4) There should be a room or place where JO's can work on their training. I have no place to do my computer training.

(5) Reduce the number of practicums and possibly make them more consolidated. There is plenty of ways to get the experience and knowledge without having to jump through hoops in order to get stuff done. Allowing more

time to work on the training would be a good help. I don't think a division should be given a new JO right away. Give him/her time to establish a good routine and to get accustomed to the program before having to run a division as well.

(6) Create an environment where there are computers and time to do it. Make installation easier. Create reasonable tests that test common knowledge that we will remember.

(7) Handbooks and slightly clearer instructions on how to maneuver the modules and course information.

(8) Issue every Ensign a computer and a set of discs. Allow more OJT in conjunction with the modules. Shorten the modules or increase the amount of lessons to decrease the amount of time spent learning. Train the trainers. Give them a course explaining the program and how to best implement it.

(9) Utilize decommissioning FFG's and DD's as "school ships" to maximize the hands-on training and dedicated training personnel.

(10) There is no doubt that much thought was put into this program…the only criticism I have lies in the program's organization and execution. There is no doubt that ships are not being given the technology equipment and guidance on how to carry out the programs intent. Training Officers are not given training on how to carry out the program. With time, it will surely improve.

(11) Send us back to SWOS. I believe it is a needed part of officer training-just shorten it some. Until the Navy can dedicate a person to teaching SWOS-at-Sea on each ship and train that person first on how to run the program, the program will not work. Then ships need the funding to run this; i.e. computers for the program and a space to work in. To make this program really effective, the Navy needs to put this program at the top of the list for all new Ensigns and their CO's. As long as the Ensigns have command duties, the program will never be effective. My personal feeling is that new officers with no prior military experience need something prior to the ship that is military in manner.

(12) We need more structured instruction and dedicated personnel. Ship's officers are too busy with other primary duties.

(13) Ensure proper training of system administrators/trainers. Provide computers devoted entirely to the SWOS-at-Sea program. Overhaul some of the lessons so they provide more relevant info in a more engaging format. Overhaul the tests so that they evaluate the material that was presented in the lessons. Solve technical problems with the program.

(14) The program should be reconstructed to be more user friendly. Without the help of someone helping me with the initial startup process I am unable to start the program at all.

Question 4. What are the best parts of this course and why?

(1) I have little experience with the course, but I like the simplicity.

(2) A lot of the material is pertinent, and beneficial. It is good to be able to study this material on your own. Some to the multimedia is interesting and helpful. Combining formalized instruction via the CD and the OJT is probably more effective than 6 months in a classroom.

(3) The information is very good, and it does reinforce our practical understanding. However, standing 5 and dimes (A type of watch section rotation where a watch stander typically stands five hours of watch and then has ten hours off before coming back on watch again) underway, it is difficult to summon one's energy to find computer time and complete lessons. We are not supposed to be division officers, and I am taking the responsibility for a lot of divisional duties because the opportunity is there.

(4) Some of the lessons have good visuals that help the learning process and could not be accomplished with a book or chalkboard. Could be a good way to learn if nothing else was going on.

(5) Interactive videos, sounds, questions. They keep my attention better than just textual slides.

(6) Saves money. Immediate utilization of bodies.

(7) The slides are very informative and contain useful information. The knowledge is presented in a plain and easily understood manner. The animation in the later slides add an element of excitement to the lessons as well as make it easier to pay attention and envision real life application of knowledge.

(8) You don't have to go to SWOS. Good way of getting information without asking people.

(9) Learn at own pace and ability to work when I have time. It allows flexibility in the schedule while still teaching me important information. The info did improve my knowledge of the ship and its abilities while seeing them first hand. I know it makes a good learning experience.

(10) The information is helpful.

Question 5. What are the worst parts of this course and why?

(1) I have difficulty saving and progress. I don't know if I am doing it wrong or there is a real problem.

(2) Technical problems with the program. A lack of guidance / instruction. NO COMPUTER AVAILABILITY; most of ship's computers being used for ships work. Some of the slides are too long and boring…not presented in an engaging format. Some of questions on the quizzes / tests asked for information that was not adequately presented in the lessons. The SWOS-at-sea program is not a priority for most ships…it is difficult to find officers who have enough time to review the material thoroughly.

(3) We need dedicated computer time and space. Dedicated instructors are needed…i.e. shore based learning center (ensuring fairness). Too many officers so we don't actually get enough driving / learning time.

(4) No human interaction for ready reference questions. The programs often don't work. Ships cannot dedicate time to working on this…there are always other things going on that are mission critical for the ship and they take priority. It is very difficult to dedicate time to learn when your have 10-12 hours of watch, 4 hours of meetings, and various other things going on with little or no sleep (A

normal underway). Underway is a bad environment for sit down learning. Some functions are hard to operate or don't work at all. To date (over 3 months), our testing CD's are not working. Other ships have reported that the tests are not saving upon completion.

(5) Length of lessons. Mundane textual slides. Difficult to maintain attention span, especially while underway and standing watches with little sleep.

(6) IT problems are rampant. The modules will not open or information will not save. Standards were never explained to the trainees, therefore performance is low. The ship was never trained in how the program should run. There are no dedicated trainers; therefore students are not a priority. The lack of training is not complimentary to the profession. Over-manning decreases hands-on training at tasks such as ship driving.

(7) Sitting at a computer reading for hours is very boring. The modules are very long and require a lot of time to complete. Procuring a computer for a sufficient amount of time to complete a module and learn the material was very difficult. Learning is not a priority onboard and outside resources were not readily available. OJT is very limited.

(8) Loss of human interaction leads to a loss of initiative. Hard to stay focused and can't ask questions on specific problems. It is very hard to balance the Divo at sea courseware requirements and qualifications. Qualifications tend to take a majority of the time which leaves less time with the courseware.

(9) There are too many slides and too much information to do while being a Divo and also learning the same stuff in your PQS. If you don't have a laptop you can't complete the computer training. Installation needs to be put into a single .exe file which is extractable with one click.

(10) There are too many activities (practicums). While I understand the relevance and importance, I frequently find myself lacking enough time to work on them. Balancing a division, watches, other PQS, and other aspects of ship life doesn't leave much time to run around looking up references and observing

evolutions, as well as cross decking to other ships to see how they do it. Just too much to do in too little time.

(11) The length of each module and how interesting the lessons are.

(12) I would like hard copy, like a textbook or (reference) TRAMAN for learning the material

(13) Give each person a set of discs.

D. RESPONSES TO SUPERVISOR SURVEY, PART III

Question 1. If the SWOSCOLCOM Division Officer at Sea Training Initiative's goals can be better defined, how would you change them to make better?

(1) When the system actually comes up on the computer, the goals are easy to identify.

(2) Better printed reference material should be provided.

Question 2. How are the students' performance standards for graded activities established? Are these standards uniform throughout the fleet?

(1) The results / answers are given through the program.

Question 3. What is done with the collected student test and activity performance data?

(1) Sent off to SWOS. Nobody has taken a test yet.

Question 4. Does the collection of student test and activity performance data enhance or benefit organizational performance? If so, how?

(1) Can't tell yet because nobody has taken a test. The Ensigns are excelling in SWO knowledge by OJT.

Question 5. Does the organization require periodic evaluations of this training initiative? If so, what aspects of this Computer-based training initiative are to be evaluated?

(1) Everything needs to be evaluated.

Question 6. What is the procedure for reporting weaknesses or deficiencies that are discovered in the SWOSCOLCOM Division Officer at Sea Training Initiative?

(1) Via Email.

(2) Email SWOS POC.

Question 7. If a weakness or deficiency is discovered in eh SWOSCOLCOM Division Officer at Sea Training Initiative, what is the maximum time that is allowed to correct it?

(1) Until it gets resolved.

(2) The problem is identified. If computer disc/software discrepancies or missing data, and turn around time until receipt of correction CD was around 2 to 3 months.

Question 8. Are standards established for the presentation of instructional material via CBT? If yes, please explain why or how those standards have or have not been met.

(1) No, zero guidance was given about the program and since it is difficult to set up on the LAN, we don't have a presentation of instructional material. It's all over the LAN and difficult to navigate through.

(2) No specific guidelines have been established as of yet. Students are expected to review modules on their own time with the primary responsibilities still being watch stander qualification and divisional obligations.

Question 9. What is / are the major strengths of this CBT initiative?

(1) Appears as though decent information is on the discs once we can pull them up.

(2) The concept of qualifying SWOS more quickly.

(3) Information/diagrams are very useful in illustrating certain theories or systems (e.g. damage control, engineering, combat systems) and have been used to garner info for larger command wide officer training.

Question 10. What is / are the major weaknesses of this CBT initiative?

(1) Difficult to navigate through. No instructions were given to the training officers. It was just sent out to the fleets. Looks like the product had not been QA'd because many modules were missing or incomplete. No real troubleshooting help is available. Not much guidance.

(2) The printed reference material is poor. The installation is poorly explained. The support to the ships is weak.

(3) Command shortage of available computer resources to dedicate to solely CBT program. Personal aspect eliminated-most instruction comes from CD's and questions or OJT issues cleared up while on watch. Loading CD's and tracking current versions while deployed was difficult. Command emphasis more towards PQS program rather than CBT now that SWOS has been essentially taken out of the picture.

Question 11. What should be done to improve this course of instruction?

(1) Instruct the supervisors before sending out the material. Have teams come to the ship and implement it on the LAN and then give lectures on how to navigate through. Explain saving and exporting data procedures.

(2) The CBT lacks Polish. Installation is a pain and there is not any real tech support. The CBT is not geared to the ship's LANs. Have had a hard time finding computers that can run the program. We have had a hard time finding computers with the appropriate software and hardware.

(3) Training seminar on the waterfront for implementation and expectations of program. With this program coming into the fleet during the beginning of the Gulf War, information and program instructions were difficult to ascertain. Hopefully, a waterfront training initiative would get everyone on the same page.

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APPENDIX C. HISTORICAL SWOS DATA

A. SWOS DOC TOPICS AND THEIR RELATIVE IMPORTANCE

Topic Number	Topic Title	Survey Score	Survey Ranking
1.01	Review Preliminary Rules of the Road	3.840	1
2.04	Standard Commands	3.811	2
2.02	R/T Procedures	3.809	3
5B.4	Opening CPA/ Avoiding Course	3.809	4
1.03	Steering and Sailing Rules	3.784	4
5B.1	Introduction to Maneuvering Boards	3.779	5
5A.5	UNREP	3.747	6
5B.2	Tracking	3.747	7
2.19	Emergency Actions	3.730	8
1.02	Lights and Dayshapes	3.722	9
2.17	Man Overboard Procedures	3.716	10
5A.13	Aids to Navigation	3.716	11
1.04	Restricted Visibility Sound and conduct	3.711	12
11.18	Firefighting School	3.710	13
5A.10	Charts and Publications	3.684	14
5A.20	GPS	3.684	15
2.11	Shiphandling Alongside a Pier	3.670	16
2.12	CONREP Conning	3.660	17
5A.19	Navigation Detail and Anchoring	3.650	18
5A.2	Mooring	3.631	19
10.01	3-M and the Division Officer	3.628	20
11.17	Buttercup Get Wet Trainer	3.622	21
5B.3	Changing of Station	3.621	22
5A.1	Deck Seamanship	3.600	23
10.05	Equipment Tag-Out	3.595	24
11.12	Personnel Protective Equipment	3.590	25
2.05	Communications and the Watchstander	3.560	26
11.11	Portable DC Equipment	3.550	27
11.07	Fires and Extinguishing Agents	3.540	28
11.09	Fixed DC Systems	3.532	29
5B.8	True/Desired Wind	3.526	30
6.13	Electrical Safety	3.526	31
3.04	Honors and Ceremonies	3.490	32
4.12	Navy Safety Programs	3.474	33
10.07	Quarterly and Weekly Schedules	3.473	34
5A.6	Flight Deck	3.463	35
6.06	PQS System With Practical	3.457	36
5B.5	Tactics, Columns, and Screen Formations	3.450	37

7.09	Tactical Data Links	3.426	38
11.02	Compartmentalization and WTI	3.426	39
3.03	Ship's Emergencies/Security Threats	3.420	40
6.02	IDTC and Division Officer Inspections	3.415	41
6.1	Casualty Reports	3.409	42
11.16	Practical DC	3.396	43
5A.12	Tides and Currents	3.390	44
10.06	Cycle Schedules	3.383	45
11.15	DC Communications and Symbology	3.380	46
6.08	Message Formatting ADP	3.376	47
11.19	CBR-D: Protective Equipment	3.374	48
11.2	CBR-D: Chemical, Biological, Radiological	3.374	49
11.05	Portable Dewatering Equipment	3.372	50
3.05	Small Boats	3.367	51
11.06	Shoring, Plugging, and Patching	3.362	52
8.05	U.S. Aircraft and Weapons	3.362	53
8.02	U.S. Combatants	3.362	54
2.09	Bridge Equipment	3.358	55
5A.3	Anchoring and Mooring to a Buoy	3.358	56
2.01	Surface Combat Information Center	3.351	57
4.05	JO Fitness Reports and Enlisted Evaluations	3.347	58
5B.6	Line Formations	3.337	59
2.07	Underway Bridge Watch Relief	3.333	60
8.03	Amphibious Ships and Craft	3.330	61
11.01	Intro and Basic First Aid	3.323	62
5A.11	Basics of Time	3.305	63
10.03	MDS and the Division Officer	3.298	64
5A.14	Compasses	3.295	65
4.02	Enlisted Rating Structure and Advancement	3.287	66
8.16	Surface Warfare	3.287	67
2.08	ATP-1 & Publication 102	3.284	68
2.03	Underway Watch Organization	3.284	69
11.14	DC Organization and Administration	3.280	70
7.08	NTDS/CDS/DTE	3.280	71
11.1	DCA School Lab Tour	3.272	72
6.04	Shipboard Training Program	3.269	73
8.06	U.S. Submarines	3.269	74
4.01	Division Officer Indoctrination	3.256	75
7.02	Shipboard Communications Systems	3.255	76
8.19	VBSS	3.247	77
3.02	Routine/special Evolutions	3.240	78
3.01	Inport Watch Organization	3.231	79
4.04	Sexual Harassment/Fraternization/Hazing	3.221	80
8.04	Auxiliaries	3.215	81
5A.7	Survival at Sea	3.213	82

8.17	Air Warfare	3.213	83
6.12	Operational Messages	3.210	84
7.03	Shipboard Satellite Communication Systems & Equipment	3.200	85
5A.21	The Future of Electronic Navigation	3.200	86
7.14	Launching Systems	3.190	87
6.01	Information Security	3.180	88
7.16	Cruise Missiles	3.170	89
7.17	Air Warfare (AW) Missiles	3.170	90
2.14	ATP & Publication 102 Assignment	3.160	91
8.18	Undersea Warfare	3.160	92
8.08	Rules of Engagement	3.150	93
7.15	Guided Weapons	3.130	94
4.03	Enlisted/Officer Service Records	3.090	95
6.03	Schools and Exercises With Practical	3.090	96
7.1	MK 15 CIWS	3.090	97
8.07	Intro to Command and Control Systems	3.080	98
2.18	Navy Publications	3.070	99
7.19	Sonar Fundamentals	3.040	100
7.06	IFF/TACAN	3.020	101
7.18	AEGIS Weapon System	3.020	102
7.23	USW Weapons	3.020	103
7.04	Radar Fundamentals and Systems	3.010	104
11.13	Basic Gas Free Engineering	3.010	105
5A.27	Electronic Navigation Practical	3.010	106
2.06	R/T Crypto System	3.000	107
2.16	Special CIC Evolutions	2.990	108
7.05	Introductions to Electronic Warfare	2.990	109
7.13	Naval Gun Weapon Systems	2.990	110
8.12	Intro to Amphibious Operations	2.990	111
5A.18	Sunrise and Sunset	2.990	112
4.06	Drug and alcohol Abuse	2.980	113
11.04	Stability	2.970	114
4.07	Good Order and Discipline/Shore Patrol	2.950	115
4.08	Manpower Documents	2.950	116
5B.7	Search Turns	2.950	117
6.05	C/S Inport Training Program	2.930	118
5A.4	Towing	2.930	119
8.14	Mine Warfare	2.880	120
8.15	Amphibious Assault	2.870	121
10.04	Alterations and Availabilities	2.870	122
6.15	CSOSS	2.860	123
7.07	The Gunfire Control Problem	2.860	124
7.2	Acoustic Propagation	2.850	125
4.13	Non-Judicial Punishment	2.820	126

7.12	Naval Ammunition	2.800	127
7.21	AN/SQQ-89(V) Part I	2.800	128
2.15	Visual Communications	2.770	129
7.22	AN/SQQ-89(V) Part II	2.760	130
8.01	Naval Doctrine	2.750	131
2.13	Subsurface Combat information Center	2.730	132
2.1	Air Combat Information Center	2.710	133
4.09	Transfers and Separations	2.690	134
8.09	Command and Control Warfare	2.680	135
7.01	Radio Wave Propagation	2.650	136
6.14	Search and Seizure	2.590	137
7.24	Ship's Silencing Program	2.570	138
8.11	Marine Corps	2.450	139
4.1	Absentees and Deserters	2.390	140
1.98	Unit 1 Exam	No Useful Data	141
1.99	Unit 1 Exam Review	No Useful Data	142
2.2	Communications Practical	No Useful Data	143
2.98	Module 2/3 Exam	No Useful Data	144
3.98	Unit 3 Exam	No Useful Data	145
4.11	Family Care Policy and Pregnancy	No Useful Data	146
4.98	Unit 4 Exam (Take Home)	No Useful Data	147
4.99	Unit 4 Exam Review	No Useful Data	148
6.07	GENADMIN Messages	No Useful Data	149
6.09	Message Writing Practical	No Useful Data	150
6.11	CASREP Practical	No Useful Data	151
6.98	Unit 6 Exam (Take Home)	No Useful Data	152
6.99	Unit 6 Exam Review	No Useful Data	153
7.97	Unit 7 Exam Preview	No Useful Data	154
7.98	Unit 7 Exam	No Useful Data	155
7.99	Unit 7 Exam Review	No Useful Data	156
8.1	Electronic Warfare	No Useful Data	157
8.13	Naval Surface Fire Support	No Useful Data	158

8.2	Intelligence Brief	No Useful Data	159
8.98	Unit 8 Exam	No Useful Data	160
8.99	Unit 8 Exam Review	No Useful Data	161
10.02	Supply and the Division Officer	No Useful Data	162
10.08	PMS Change Manual and Spot Check	No Useful Data	163
10.12	Automated MDS I	No Useful Data	164
10.16	MDS/PMS Practical Review	No Useful Data	165
10.98	Unit 10 Exam	No Useful Data	166
10.99	Unit 10 Practical Review	No Useful Data	167
11.03	Firemain and Drainage Systems	No Useful Data	168
11.08	The AFFF System and Magazine Sprinklers	No Useful Data	169
11.97	Unit 11 Review for Test	No Useful Data	170
11.98	Unit 11 Exam	No Useful Data	171
11.99	Unit 11 Exam Review	No Useful Data	172
12.06	Simulator Indoctrination	No Useful Data	173
12.07	DRT and Scopehead Plotting	No Useful Data	174
5A.15	Piloting I	No Useful Data	175
5A.16	Piloting II	No Useful Data	176
5A.17	Piloting III	No Useful Data	177
5A.25	Navigation Practical I	No Useful Data	178
5A.26	Navigation Practical II	No Useful Data	179
5A.98	Unit 5A Exam	No Useful Data	180
5A.99	Unit 5A Exam Review	No Useful Data	181
5B.10	Maneuvering Board Practical Review	No Useful Data	182
5B.11	Maneuvering Board Pre-test	No Useful Data	183
5B.12	Unit 5B Exam	No Useful Data	184

5B.13	Unit 5B Exam Review	No Useful Data	185
5B.9	Maneuvering Board Practical	No Useful Data	186

Table 4. Importance Ratings of Topics from IDSI Final Report (pp. H1-H24)

B. AVERAGE NUMBER OF FAILURES PER CLASS (NON ENGINEERING)

The information below was taken directly from the Microsoft Excel files maintained at SWOS. This information does not include data from the engineering curriculums (Core Phase II).

Sample Number	CLASS NUMBER	Unit 1	Unit 2/3	Unit 4	Unit 5	Unit 6
1	109	7	12	0	25	0
2	110	17	4	0	34	5
3	111	24	33	0	41	7
4	112	0	2	0	9	0
5	113	0	29	2	18	9
6	**114**	18	29	1	32	7
7	**115**	17	28	2	31	34
8	**116**	28	10	1	45	5
9	**117**	5	3	2	27	5
10	**118**	9	14	3	34	3
11	**119**	24	2	3	26	13
12	**120**	15	13	5	72	4
13	**121**	9	20	2	77	10
14	**122**	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
15	**123**	12	31	12	59	6
16	**124**	22	11	21	74	5
17	**125**	32	9	13	47	1
18	**126**	11	7	8	38	2
19	**127**	22	10	9	33	1
20	**128**	14	15	9	18	2
21	**129**	24	7	2	32	13
22	**130**	16	4	2	21	4
23	**131**	63	6	9	24	4
24	**132**	19	6	1	24	2

25	**133**	66	5	6	44	1
26	**134**	54	3	1	58	13
27	**135**	36	1	1	64	6
28	**136**	53	15	13	94	8
29	**137**	45	41	6	82	13
30	**138**	39	28	3	10	8
	Totals:	**701**	**398**	**137**	**1193**	**191**
Ave Number of Failures per class:		**24.172**	**13.724**	**4.724**	**41.138**	**6.586**
Ave Class Failures as a Percentage:		**13.24%**	**7.52%**	**2.59%**	**22.53%**	**3.61%**
Sample Number	**CLASS NUMBER**	**Unit 7a**	**Unit 7b**	**Unit 8**	**Unit 9/10**	**Unit 11**
1	109	5	17	0	7	2
2	110	85	4	5	3	4
3	111	7	17	3	9	18
4	112	10	6	1	2	5
5	113	18	7	3	5	13
6	**114**	32	16	22	6	5
7	**115**	49	52	14	13	4
8	**116**	13	17	61	4	2
9	**117**	4	11	0	0	1
10	**118**	13	9	27	3	2
11	**119**	14	15	27	6	2
12	**120**	5	10	28	3	37
13	**121**	31	7	41	20	13
14	**122**	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
15	**123**	27	7	18	19	6
16	**124**	12	23	32	12	16
17	**125**	6	3	35	22	9
18	**126**	7	6	23	8	13
19	**127**	5	5	4	3	3
20	**128**	18	33	17	7	2
21	**129**	24	32	28	11	8
22	**130**	5	30	40	2	8
23	**131**	11	43	26	15	9
24	**132**	3	14	19	16	4
25	**133**	20	22	16	19	9
26	**134**	41	12	18	6	9
27	**135**	45	20	41	9	23
28	**136**	33	31	43	15	24
29	**137**	80	82	58	4	44
30	**138**	19	77	0	12	24

	Totals:	642	628	650	261	319
Ave Number of Failures per class:		**22.138**	**21.655**	**22.414**	**9.000**	**11.000**
Ave Class Failures as a Percentage:		**12.12%**	**11.86%**	**12.28%**	**4.93%**	**6.02%**
Sample Number	**CLASS NUMBER**	**5a exam**	**5b exam**	**Quiz Scores**		
1	**109**	Unavailable	Unavailable	Unavailable		
2	**110**	Unavailable	Unavailable	Unavailable		
3	**111**	Unavailable	Unavailable	Unavailable		
4	**112**	Unavailable	Unavailable	Unavailable		
5	**113**	Unavailable	Unavailable	Unavailable		
6	**114**	Unavailable	Unavailable	Unavailable		
7	**115**	Unavailable	Unavailable	Unavailable		
8	**116**	Unavailable	Unavailable	Unavailable		
9	**117**	Unavailable	Unavailable	Unavailable		
10	**118**	Unavailable	Unavailable	Unavailable		
11	**119**	14	35	68		
12	**120**	70	60	76		
13	**121**	61	62	74		
14	**122**					
15	**123**	46	61	50		
16	**124**	70	65	109		
17	**125**	34	44	54		
18	**126**	37	30	50		
19	**127**	34	28	44		
20	**128**	10	16	49		
21	**129**	17	16	83		
22	**130**	9	12	54		
23	**131**	14	17	77		
24	**132**	12	19	65		
25	**133**	25	29	119		
26	**134**	30	38	115		
27	**135**	16	56	160		
28	**136**	48	69	122		
29	**137**	78	44	110		
30	**138**	8	14	117		
	Totals:	**633**	**715**	**1596**		
Ave Number of Failures per class:		**33.316**	**37.632**	**84.000**		
Ave Class Failures as a Percentage:		**18.25%**	**20.61%**	**46.01%**		

Table 5. Historical Failures per Unit

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